A MATCH MADE AT WOODSTOCK P. 6 • BUZZ ALDRIN RECALLS HIS MOON LANDING P. 26

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PHOTOGRAPH BY DUBY TAL / ISRAELIMAGES

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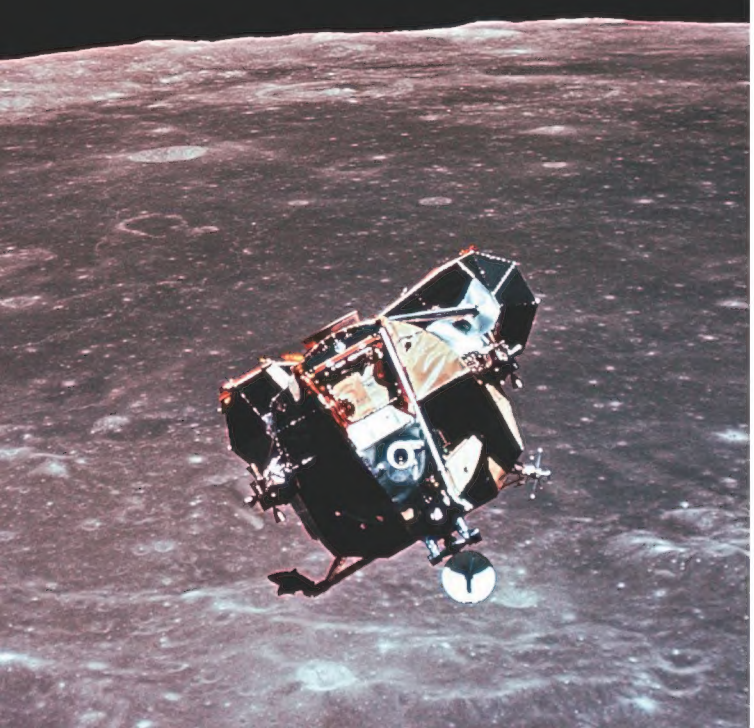

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FROM THE EDITOR

Strongmen

Larger than life, for ill and good

BY CAREY WINFREY

BARBARA KREIGER teaches English and creative writing at Dartmouth College. She has been fascinated by King Herod, ruler of Judea at the time of Jesus' birth, since she began researching a book about the Dead Sea more than 25 years ago. So when she read in 2007 about the probable discovery of Herod's tomb, her passport was at the ready. Kreiger flew to Tel Aviv and soon met up with archaeologist Ehud Netzer, who guided her through the site as well as through the thinking that led him to his sensational find; so began the reporting that would become this month's cover story, "Finding Herod's Tomb," page 36.

"This is a classic needle-in-a-haystack scenario," Kreiger says of Netzer's 35-year search for the murderous ruler's final resting place. "Here in front of you is an enormous mountain, an enormous haystack, and how do you find the needle?" Answer: enthusiasm and perseverance. "Watching Netzer work alert and excited—watching this older man walking as though his feet have memorized the site—is inspiring. I'm continually struck by his constant delight in his work. His eyes light up as he's describing something, even though to him it may be old hat. He invests himself in such a way that makes it come alive."

Kreiger: Passport at the ready

JONATHAN BLACK is a former managing editor of *Playboy* and former executive editor of *GQ* who teaches writing at the Medill School of Journalism at Northwestern University. His interest in the history of fitness and "how we have become so obsessed with our bodies" led him—it would seem inevitably—to bodybuilder Charles Atlas and his "Dynamic-Tension" program, which took off during the Depression, helping generations of 97-pound weaklings deal with bullies at the beach. Atlas, Black says, "came from a time when we were all a lot more innocent, but also a time when people were feeling down about the future of the world, the country and themselves. He gave them a reason to think, well, you can at least do something about yourself. It was probably why his stuff caught on as much as it did back then, but it resonates today as well." Atlas achieved a kind of iconic status and personified the idea that one can start with nothing and end up rich and revered. Says Black: "That just speaks so much to the American dream and the kind of optimism that's run through our country since its founding. He's an unsung pioneer of the self-help movement." Black's story, "Muscle Man," begins on page 64.

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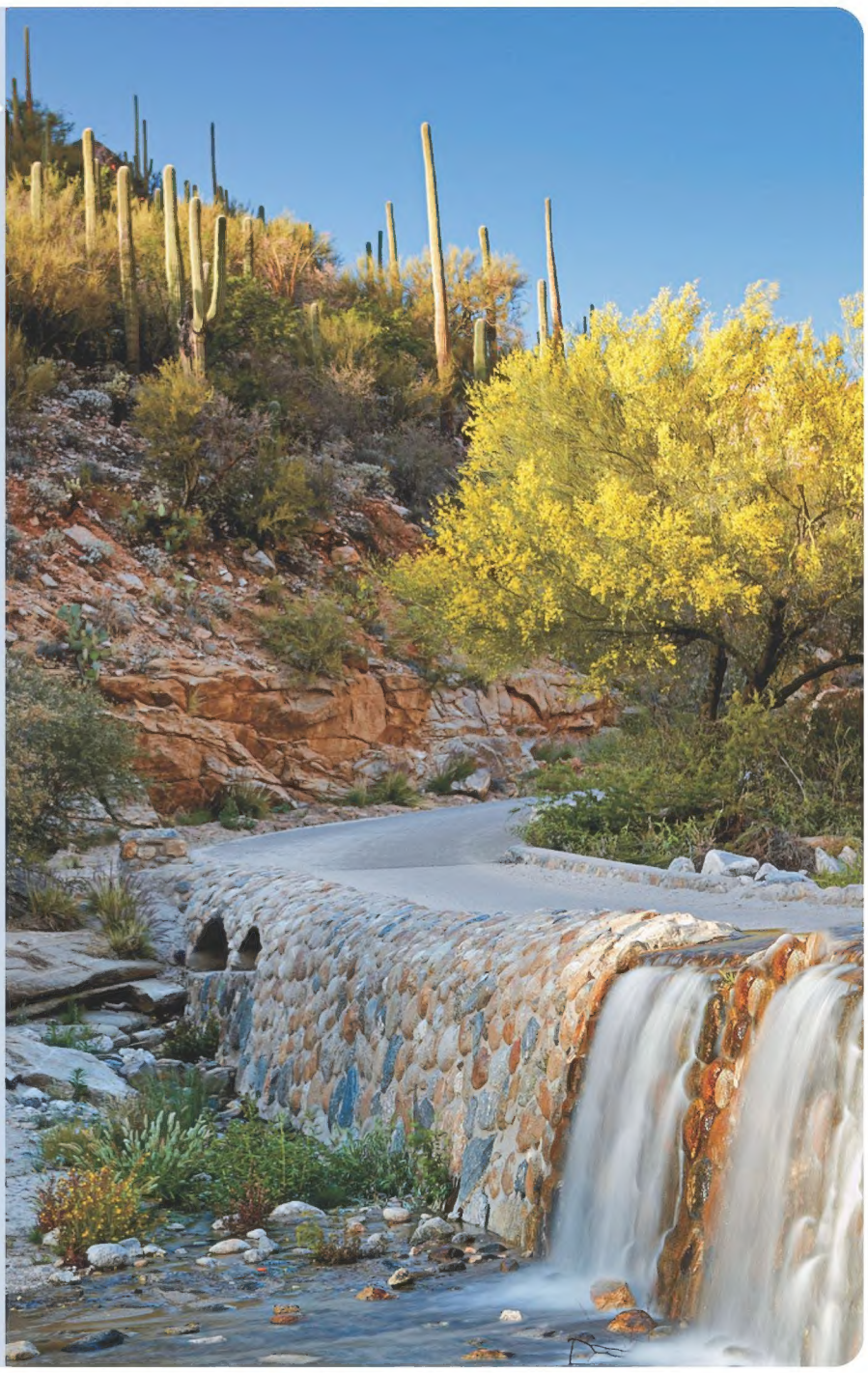
YOUR KIND OF TOWN

BY DEBORAH WHITAKER • TUCSON, ARIZONA

ONE OF THE THINGS that make Tucson special is Sabino Canyon (right). I love getting up early, just as the sun is starting to rise, and striking out on the road up the canyon. Around me are dozens of other people doing the same, singly or in groups, smiling and nodding "good morning" to each other. Once, there was a man singing opera as he made his way. I start out walking through the dry desert, but then I make it over the first big hill at the one-mile marker and I am in the canyon, looping back and forth over the stream as I climb higher in the mountains. The stream is always changing. Sometimes it's high and I have to wade through it. Other times, I see parts of the streambed exposed that I have not seen before. The sound of doves accompanies me, and I have to watch out for the occasional rattlesnake crossing the road.

Submit a **Your Kind of Town** story or photograph and find others at Smithsonian.com/yourkindoftown



REST HOME

I hope to be buried here at home. My coffin is already constructed and standing upright in my library, holding books. The shelves will be easily removed when the time comes. My boys will probably use my lawn tractor to haul me up to my chosen site.

—David Montague, St. Johnsbury, Vermont, on "The Surprising Satisfactions of a Home Funeral" Smithsonian.com/funeral

THE LONG VIEW

This is the high-water mark of our technical culture so far. With this great instrument, we stare off into the beginning of time and the edge of space (left: the Crab nebula) and find it beautiful. That's our job as sentient blobs of matter, near as I can figure. I'm glad I had a hand in it, if only as a taxpayer.

—Jack Romanski, Berkeley, Calif., on "The Hubble Space Telescope's Finest Photos" Smithsonian.com/hubble

PHOTO CONTEST

EDITORS' PICK

"I came around the corner and she was sitting there. It was one of those moments when everything worked."

—Onno Vandelaak, of Nijmegen, The Netherlands, on his photograph in old Havana, Cuba

Visit our Web site to submit a photo to our 7th annual contest.

CAPTION CONTEST

SAWBONES?

There are several mannequins and two Smithsonian Institution staffers in this 1976 photograph from the archives. What's going on? You tell us. Submit a caption by August 12 at Smithsonian.com/caption

SEE THE WINNING ENTRY FOR THE JUNE CAPTION CONTEST AT SMITHSONIAN.COM/CAPTION

DENNIS FRATES / ALAMY; RON CHAPPLE STOCK / PHOTOLIBRARY; NASA; ONNO VANDELAAK; SMITHSONIAN INSTITUTION ARCHIVES

LETTERS READERS RESPOND TO THE **JUNE** ISSUE

The United States government tried to get as many Amerasians out of Vietnam as it could before the Communist takeover ["Children of the Dust"]. But as a military spouse and Babylift volunteer, I saw a number of parents of full Vietnamese infants and children, apparently wanting a better life for their kids, rush to the planes and thrust them into the arms of whomever they could, then run away.

KATHY MANNEY, LAS VEGAS, NEVADA

AGENTS FOR CHANGE

I ENJOYED the article on the Amerasians and felt it was well written and researched—with one exception. Four high-school students (who wrote a petition in 1986 and got 27,000 people to sign it) played a pivotal role in motivating their congressman, Robert Mrazek, to spearhead the drive to bring Amerasian children to the United States. Yet those students remain nameless in a human story that may not have happened had they not believed in their abilities to effect positive change. I think the magazine should print their names, not only to honor their dedication to social justice but to remind readers of what anthropologist Margaret Mead said so eloquently: "Never doubt that a small group of thoughtful, committed citizens can change the world."

EMILY GOLDMAN
WASHINGTON, D.C.

The four students were David Zach, Susan Forte, Marlo Sandler and Tara Scalia.—Ed.

COMMAND DECISION

WHEN I READ "Recovered Ground," Benjamin W. Patton's article about his father, Gen. George S. Patton IV, I was reminded of an encounter with the general in the late 1970s when I was a public affairs officer in the Army Reserve. A press officer from Fort Hood preceded Patton by a day to lay ground rules for the local press and their questions to this son of a very famous general. The major said: "There will be absolutely no questions about General Patton assuming his father's old command at Fort Hood (2nd Armored Division) and absolutely no questions about how it feels to be the son of a famous World War II general." When General Patton's helicopter landed the next day, the major asked if I understood everything. I do, I replied. But, I added, the members of the press are civilians and neither you, I, nor the general can stop them from asking questions. The major walked to the helicopter and said something to General Patton, who looked over the major's shoulder at me and at the crowd of reporters. He just shrugged his shoulders, got back into the helicopter and flew away. He was, after all, a general, and I had no control over him either.

BILL HERRIDGE
GATESVILLE, TEXAS

AN AUTISTIC CONNECTION?

I HAVE JUST finished reading your fascinating story "The Social Brain." The deficits the article describes in patients suffering from frontotemporal dementia are similar to those of autism. People with autism frequently lack empathy, have poor social graces and are generally socially impaired. As a teacher of special education, I wonder if the von Economo neurons in people with autism spectrum disorders may be negatively affected and, perhaps, may be one of the reasons for the antisocial behavior found in these people. I am curious to know if any studies have been done connecting these brain cells to autism spectrum disorders.

MARY COONERTY
BLUE POINT, NEW YORK

Response from neuroscientist John Allman, California Institute of Technology, Pasadena: *We are investigating the possibility that the von Economo neurons (VENs) are involved in autism. A new method developed by my collaborator, Barbara Wold, enables us to measure gene expression in autopsy brains of autistic subjects and controls. This work follows from our theory that the VENs are related to intuition and social reciprocity.*

SUBSTANCE AND STYLE

I ENJOYED "The Triumph of Frank Lloyd Wright," about his design of the Guggenheim Museum. It is always confusing when going from one room to the next in a museum to know which way to turn. Wright's spiral ramp solved two problems: it made it easier to walk, by forcing visitors to travel down a slight incline, and it eliminated the problem of having to determine which way to turn when entering a new room.

JOHN MOOD
SAN DIEGO, CALIFORNIA

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Still Together Now

The muddy couple photographer Burk Uzzle made a symbol of the Age of Aquarius are holding on to that lovin' feeling

BY TIMOTHY DUMAS

ON AUGUST 15, 1969, Nick Ercoline was tending Dino's bar in Middletown, New York, while his girlfriend of ten weeks, Bobbi Kelly, sat on a stool, sipping nickel draft beer and listening to the news on the radio. In the past 30 days, Senator Ted Kennedy had driven off a bridge at Chappaquiddick Island, the *Apollo 11* astronauts had planted a flag on the moon and the Charles Manson family had murdered eight Californians, including actress Sharon Tate, in Los Angeles. In the soft green hills of Catskills dairy country, such events seemed worlds away.

That Friday night, however, waves of American youths were surging toward Max Yasgur's farm in Bethel, New York, 40 miles up the road, for three days of something called the Woodstock Music and Art Fair. A hush fell over Dino's as newscasters told of epic traffic jams and crowd estimates rising to 500,000. When they heard a rumor (false, it turned out) that a glut of cars had shut down the New York State Thruway, the 20-year-old sweethearts could no longer resist. "We just got to thinking, we were never going to see anything like this the rest of our lives, ever," Nick says.

Earlier that same day, photographer Burk Uzzle, a *Life* magazine alumnus and a member of the elite Magnum photo agency, had driven upstate from Manhattan with his wife and two young sons to camp on the trout-filled Neversink River. Uzzle had declined an invitation from *Newsweek* to cover Woodstock, thinking he would

Two in half a million: Bobbi Kelly and Nick Ercoline greet the dawn on August 17, 1969.

BURK UZZLE

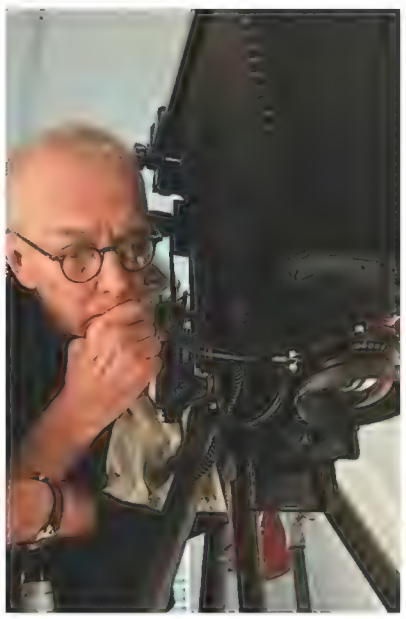
"We were not out-and-out flower power. . . . I was just a country girl. He was just a two-job college student."

just duck in and shoot it his way instead, then retreat to his campsite. "I really don't like to work on assignment, to tell you the truth," he says. "Because then I'm obligated to do what editors want me to do, and that's usually the wrong thing."

As Uzzle walked amid Woodstock's many potential disasters—rain, drugs, food and water shortages—he felt something of an Aquarian spirit in the air. "I'd say to my colleagues down by the stage, 'Hey, you guys, it's incredible out there. The girls are taking their clothes off. The guys, too. It's really beautiful,' " he recalls. "And they'd tell me, 'No, no, no, the editor wants me to stay here and get Ravi Shankar.' "

On Saturday morning Nick and Bobbi, with friends Mike Duco, Cathy Wells and Jim "Corky" Corcoran, a Vietnam veteran fresh from the Marines, set off in Corcoran's mother's 1965 Impala station wagon down country lanes and across cow pastures. In standstill traffic a few miles from Bethel, they parked the Impala, flagged down a van full of naked hippies, then walked the final stretch to Yasgur's farm. A spaced-out Californian named Herbie tagged along, carrying a wooden staff with a plastic butterfly dancing from the tip. The group claimed a patch of mud on the rim of a slope. "It was a sea of humanity," Bobbi says. "Someone with a guitar here, someone making love there, someone smoking a joint, someone puking his brains out, the din of the music you could hear over all of this—a bombardment of the senses."

Early Sunday morning, Uzzle, happily stuck at Woodstock, left his makeshift tent with two Leicas strapped round his neck. "Gracie Slick of Jefferson Airplane was singing, bringing up the dawn," he remembers. "And just magically this couple stood up and hugged." They kissed, smiled at each other, and the woman leaned her head on the man's shoulder. "I just had time to get off a few frames of black and white and a few of color, then the light was over and the mood was over," Uzzle says of what would become his best-known photograph. His subjects never noticed.



Uzzle (in December 2008): "Magically this couple stood."

One night in 1970, Corcoran brought the just-released *Woodstock* soundtrack album to Bobbi's apartment. The cover showed a vast hillside strewn with sleepy bodies and a couple locked in a tired, happy embrace. "That's Herbie's butterfly," Nick said, his eye going to the bright spot of color. Corcoran told him to look again. "Oh, hey! That's Bobbi and me!" (Over the years, several people have seen themselves as the couple on the album cover. Corcoran, cropped out of that image, appears in the full frame, lying in an Army blanket. "There is no doubt in my mind that it's me and Bobbi and Nick Ercoline," he says.)

"I met Nick, we fell in love and it was the beginning of my best life," says Bobbi (with husband Nick in May 2009).

After that first shock of recognition, the couple gave little thought to the photograph for nearly two decades, until *Life* tracked down Bobbi for a 20th-anniversary article in 1989. "After hearing our story," she says today, "I think some people are disappointed that we were not . . . "

" . . . Full-fledged hippies," Nick says.

"That we were not out-and-out flower power and revolution. I was just a country girl. He was just a two-job college student." Married for 38 years with two grown sons, they now live in Pine Bush, 45 minutes southeast of Bethel. Bobbi is an elementary school nurse; Nick, a retired carpenter, is a building inspector for Orange County.

Uzzle, 71 and living in his native North Carolina, is still making photographs. His work hangs in galleries and museums around the world. And his Woodstock photograph hangs, poster-size, above Nick and Bobbi's breakfast table.

"I look at it every day," Bobbi says. "I met Nick, we fell in love and it was the beginning of my best life." The embrace may have been theirs alone, but the image captures a romantic moment in America's collective memory. If that moment would soon seem overtaken by Altamont or Kent State or Cambodia, then Nick and Bobbi's marriage offers reassurance: the Woodstock moment was real, and it endures.

TIMOTHY DUMAS, *author of the true-crime book* Greentown, *writes frequently about the arts from his base in Connecticut.*

BURK UZZLE; KEITH BARNES

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THIS MONTH IN HISTORY

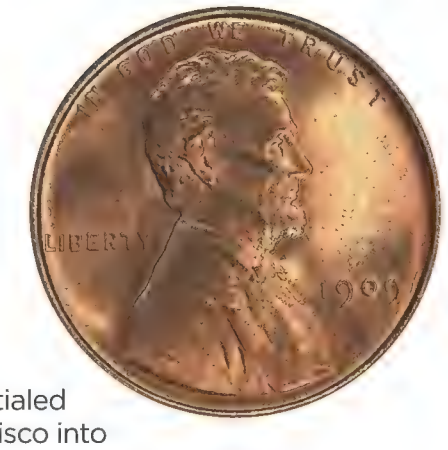
AUGUST ANNIVERSARIES
MOMENTOUS OR MERELY MEMORABLE

BY ALISON McLEAN

70 YEARS AGO
THERE'S NO PLACE LIKE OZ

MGM's *The Wizard of Oz* premières in Wisconsin, California and New York City in August 1939. Critics rank the Technicolor musical version of L. Frank Baum's 1900 book with Disney's *Snow White,* and it grosses $3 million—but it is the nearly annual television airings from 1956 on that make *Oz* one of the world's most watched movies.

100 YEARS AGO
UNCOMMON CENTS

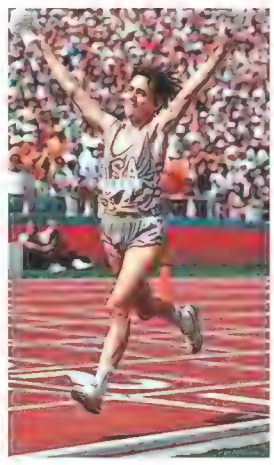


In August 1909, one hundred years after his birth, Abraham Lincoln goes into circulation—on the penny. It is the first time a portrait appears on a regular issue U.S. coin. Designer Victor David Brenner's initials, which appear on the back, are later removed, making the 484,000 initialed 1909 pennies minted in San Francisco into collector's items that have sold for thousands of dollars. Today, despite repeated congressional attempts to abolish it, the penny—which is only 2.5 percent copper—survives.

50 YEARS AGO ALOHA, HAWAII

Sixty-one years after Hawaii's annexation by the United States, President Eisenhower proclaims it the 50th state, August 21, 1959. For the second time in a year—Alaska joined the Union in January—Ike unfurls a new national flag, which flies officially on July 4, 1960. Hawaii quickly sends representation, including Hiram Fong, the first Asian-American senator, and Daniel Inouye, the first Japanese-American congressman, to Capitol Hill.

25 YEARS AGO MARATHON WOMAN



American Joan Benoit, 27, bests the competition and the Los Angeles smog to capture the gold in the first women's Olympic marathon, August 5, 1984. By mile three, Benoit, who had recently had knee surgery, is ahead of the 49 other runners; she medals with a time of 2 hours 24 minutes 52 seconds. "I did not want to take the lead," she says later, "but I figured if no one was coming with me, I might as well go." In 2008, her time of 2:49:08 at the Olympic trials sets a record for the 50+ age group.

70 YEARS AGO LOOK MA, NO PROPELLERS

Although British aviation engineer Frank Whittle had tested a working jet engine in 1937, it is Germany's Hans von Ohain who puts the first jet plane—the Heinkel He 178—in the air, on August 27, 1939. In a demonstration, pilot Erich Warsitz flies the jet a few times around Marienehe airfield. "I did say a prayer asking that the turbine blades didn't fall off," von Ohain recalls later. Air marshal Hermann Goering is uninterested, and jets don't join the *Luftwaffe* until 1944. The He 178 prototype, kept in a museum, is destroyed by British bombs in 1943.

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MY KIND OF TOWN

TELLURIDE, COLORADO

Out of the Box

The fiction writer calls Telluride's anti-commercialism—epitomized by a landmark swap stop—worth fighting for **BY ANTONYA NELSON**

PHOTOGRAPHS BY SCOTT S. WARREN

ONE WAY TO THINK ABOUT Telluride, Colorado, is as Aspen's younger, less glamorous, not so naughty sister. Telluride watched with envy and alarm as Aspen was transformed from low-key to outlandish, tomboy to sex symbol, its small businesses succumbing one by one to chic urban counterparts, haute-couture and -cuisine replacing Wranglers and hamburgers, hot tubs instead of horse tanks. Aspenization, I've heard it called. It conjures up a cautionary tale, the story of a town that made deals with developers, forsook its roots in ranching and mining and sold its soul for a hefty check.

Aspen residents saw too many of their open spaces filled with mansions and gated communities replete with movie stars. The locals found themselves dealing with traffic lights and traffic jams, then realized they'd priced themselves out of their own homes, property taxes having risen with the town's popularity. By the time everyone grew tired of the endless

Telluride (top) fears becoming another Aspen, says Nelson (above), which "sold its soul."

FREE BOX
THE FREE BOX IS NOT A PLACE FOR PAINT, TIRES OR ANY OTHER HAZARDOUS MATERIALS
EACH FRIDAY THE FREE BOX WILL BE COMPLETELY CLEANED OUT.
Thank You!

At the Free Box (above), people can exchange things they no longer want for things they do. But more than just a recycling site, "the town's hub," as the author calls it, represents a "patch of common ground"—a give-and-take that defines the community.

whine of private jets, Aspenization had become something to avoid—not so much Cinderella as Anna Nicole Smith. In Telluride, where I've spent all of my 48 summers, fear of following in the footsteps of a scary elder sibling has been around since the 1970s, when the first ski slopes began to open up.

Before that, Telluride had been in decline. In the '60s, the local mining company, Idarado, was extracting dwindling amounts of metals from the San Juan Mountains. The remaining miners were described, all too aptly, as a "skeleton crew": they rattled around the old ore-processing mill that stood between toxic ponds and hills of tailing. It could have been the setting of a creepy Scooby-Doo adventure; eventually it was a cleanup site.

My recollection of my family's early days in Telluride is one of dusty streets and oddball residents, an overabundance of roaming dogs, rusty implements hidden in brush and marsh (we had annual cause to evaluate each other's tetanus status), and abundantly available real estate. It was a town of things abandoned: people, pets, tools, jobs, homes. My family's summer houses (two miners' shacks, plus random sheds, with ten adjacent, gloriously empty lots for hanging laundry, throwing horseshoes, collecting rocks and planting aspen and spruce trees) were centrally located, up on a slight hill, in the center of the sunny side of town. There they stood along with Main Street businesses, banks and bankers, the old hospital (now the town's historical museum), Catholic, Baptist, Presbyterian and Episcopalian churches, grand Victorian homes of mining upper management and a remnant smattering of miners' cabins. The shady side, where the mountain's box canyon cuts off the winter sun, housed the ethnic miners and the prostitute cribs. The first condominiums went up there. From the sunny side of town you literally look down on the shady side; then, as now, the real estate rallying cry was "location, location, location."

My father and uncles (who were English professors in their other lives) became summer barkeeps, honorary deputies, temporary Elks Club members, Masons. They stocked fingerling trout; they were volunteer firemen. They hung around with people named Shorty and Homer and Liver Lips and Dagwood (who was married to Blondie). We decorated our Jeep and marched in the Fourth of July parades. In the 1960s, the transition from mining town to hippie enclave suited my family's temperament and budget. We'd been campers, and our miners' shacks were much-improved versions of tent or trailer. Graduate student drifters were our guests; some stayed on, becoming sheepherders or contractors or real estate agents.

The arrival of the skiers and condominiums sparked a plea for historic preservation and led to a strict set of building codes that remain in effect today. Gas stations are illegal within city limits as are neon signs and billboards. Modern structures have to fit into the town's historic scale and design. Just to

change the color of your roof requires permission from the Historic and Architectural Review Committee (HARC). The codes are extensive.

Telluride is a beautiful place in which to wander, its gardens and houses well kept and properly scaled, the mountains themselves, protecting the little city in their bowl, forever breathtaking. Most of the stores are locally owned. There are no traffic lights, strip malls, box stores or massive parking lots. The ugliest thing within a 50-mile radius is the airport, and even it is set upon a stunning plateau, beneath majestic mounts Sunshine and Wilson and Lizard Head.

Along with HARC, another '70s arrival was the Free Box. It came from Berkeley, people said, and I suppose it was an early form of recycling: a bookcase-like structure into which people placed what they no longer needed and took what they liked.

The Free Box, situated a mere three blocks from my family's remaining house (still an uninsulated miner's shack resting on rocks rather than a real foundation, surrounded now by Victorian-style manors and manicured lawns), soon became the town's hub. There, locals would linger, glancing over its labeled shelves—boys, girls, men, women, books, housewares, jackets, shoes, etc.—to see what might be of use.

Over the years I've retrieved a down sleeping bag, coffee table, hammock, headboard, ice chest, file cabinet, sink, television and several typewriters (invariably with exhausted ribbons). My children have brought home countless toys and gadgets; guests have picked up temporary necessities, ski poles or sweatshirts, and returned them at visit's end. A hoard of young cousins brought home a giant papier-mâché cake with wooden handles and a trap door beneath its test-tube-size candles. Somebody had made it for a surprise party, built to allow a person (naked lady?) to pop out. The purple and white monstrosity sat in our yard for a few weeks, melting in the rain.

The Free Box is even a useful navigational tool. Place yourself there and west is out of town; east is toward the dead-end box canyon and inimitable Bridal Veil Falls; south is Bear Creek Road, the most popular hiking destination; and north leads—among other things—to our little house, crooked and dwarfed, on whose porch sit two perfectly good chairs carried home a few years ago from the Free Box.

In the old days, a man nicknamed the Polite Motorcyclist (he never revved his engine when he went by, coasting on gravity) stationed himself at the box, hand-rolling cigarettes and monitoring visitors. Brother Al, priest and civic servant, swept the sidewalk. For a while the city had essentially taken over the box's maintenance, which, the town manager estimated, amounted to something like $50,000 a year. Last fall some residents wanted to get rid of the box or at least have it relocated, complaining that the upkeep was costing the city too much and that it had become an eyesore—and it's true the contents were often of dubious use (broken crockery, half-filled food packages, outdated catalogs). To preserve the landmark, a local citizen's group, Friends of the Free Box, stepped in and since the winter have taken over the care of the box, posting a bulletin board to list big items and hauling away trash.

Still, in a town that every year seems to grow closer and closer to that place it feared becoming—movie stars and other extraordinarily wealthy people live here now; the gated communities and private jets have arrived; articles on the need for "affordable housing" run alongside the ubiquitous Sotheby Realty ads in the town newspaper—I don't think I'm alone in clinging to the markers of Telluride's resistance. The Free Box is one of those, a small patch of common ground. Drop off a DVD of a Cary Grant movie and see it fly into a stranger's parka pocket; hold up a black cashmere sweater and get a nod of approval—*lucky you, to grab it first*—from the thrift-store maven. Send the kids out to occupy themselves, to discover some curiosity or treasure there. Later, you can give it back.

You take and you give, give and take. Maybe we can reassure ourselves we won't entirely turn into Aspen if we still have the Free Box.

Tucked in a box canyon (left: a gondola shuttles to nearby Mountain Village ski resort), Telluride enjoys stunning views of the San Juan Mountains. The town's Victorian homes and remnant miners' shacks (right) have made it a National Historic Landmark.

ANTONYA NELSON's Nothing Right *is the latest collection of her short stories.*

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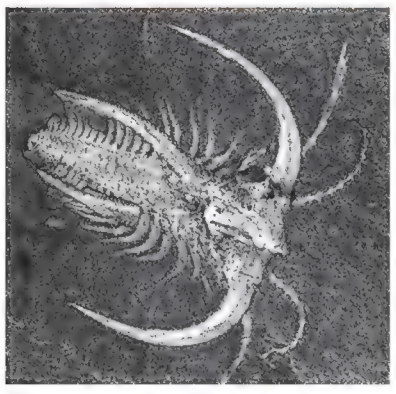
Evolution's Big Bang

A storied trove of fossils from Canada's Burgess Shale is yielding new clues to an explosion of life on earth **BY SIOBHAN ROBERTS**



The rich fossil repository known as the Burgess Shale was first discovered a century ago. (Top: Caron, center, with colleagues near the original quarry; above: a *Marrella.*)

SIOBHAN ROBERTS; CHIP CLARK, SI

THE FOSSIL-HUNTING EXPEDITION began with a lung-busting hike, accompanied by an incessant ring-ding-ting-clank-clank-ring-ting-ding-clank. The soundtrack came courtesy of an anti-bear bell attached to the backpack of the group's leader, Jean-Bernard Caron, a curator of invertebrate paleontology at Toronto's Royal Ontario Museum. After four hours of hiking up switchbacks through an evergreen forest deep in the Canadian Rockies, Caron suddenly took off like a mountain goat. As the others caught their breath, he zipped his way across loose and jagged rock up the final ascent. Eventually the team reunited at the top of the cliff and collapsed, surveying the view over the Burgess Shale.

Walcott wrote that he had "found some very interesting things." Talk about understatement.

The creatures preserved in the Burgess Shale may look strange, but they include the ancestors of most modern animals, including vertebrates—that is, us. (Clockwise from top left: *Hallucigenia*, now classified as a worm; head of a three-foot-long *Anomalocaris*; carnivorous *Sidneyia*; an artist's rendition of the Cambrian Period.)

"Yay! Fossils! We're really here!" exclaimed Allison Daley, a graduate student from Sweden's Uppsala University. She bit into an Oreo cookie and fanned her face in nervous excitement.

The Burgess Shale is Mecca for paleontologists. Charles Doolittle Walcott, the fourth Secretary of the Smithsonian Institution, discovered this rich fossil bed a century ago, in the summer of 1909, and named it for nearby Mount Burgess. At the end of his first field season here, Walcott wrote in a letter to a colleague that he had "found some very interesting things." Talk about understatement. The Burgess fossils tell nothing less than the story of the Cambrian explosion—evolution's Big Bang—when relatively simple organisms rapidly diversified into the sorts of animals that live today. The exquisitely preserved Burgess specimens (most likely entombed by underwater mudslides) include the remnants of soft-bodied organisms, which are rare in the fossil record. The animals inhabited the ocean floor 505 million years ago, near the end of the Cambrian Period.

"Most of the phyla we know today we can see already in the Cambrian and the animals of the Burgess Shale," said Caron. But the fossils still look very strange. "They certainly show evidence of evolution," Caron said. "The animals that you see there don't look like the ones we have today."

After recovering from the climb, the crew began to explore the most famous Burgess Shale site, a tennis-court-size rock exposure now called Walcott Quarry, where Walcott first found fossils. Over nine field seasons he collected 65,000 specimens, and the site has since been picked over by innumerable expeditions; finding any more fossils of interest would test both patience and passion. Even so, the team dispersed over the scorching hill, pulling out one slab of green-gray shale after another, checking both sides for a faintly textured squiggle or shadow. Since fossils are somewhat easier to see when the rocks are wet, the researchers occasionally licked the slabs.

"It's like playing the slots," said Jason Loxton, a graduate student at Dalhousie University in Halifax, Nova Scotia. "Pulling and pulling, and pulling and pulling and pulling. You've gotta get one eventually. Then maybe someone beside you wins. And then you just have to keep going."

Walcott identified his specimens as members of extinct or modern groups, such as the arthropods (shrimp, crabs, insects and the like) or annelids (segmented worms). In 1989, paleontologist Stephen Jay Gould popularized Burgess' "weird wonders" in his best-selling book *Wonderful Life*. But he argued that Walcott had erroneously shoehorned the fossils into existing taxonomic groups. He suggested that the curious "problematica" fossils that had long defied scientific identification—such as *Hallucigenia*, an inch-long creature with two rows of spines on its back—deserved their own taxonomic groupings.

Lately, paleontologists have begun re-examining the classifications yet again, largely in response to the discovery of Burgess-type fossils in Australia, China, Greenland, Russia, Spain and the United States. With more speci-

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CHIP CLARK, SI; J.B. CARON, WITH PERMISSION OF THE ROYAL ONTARIO MUSEUM AND PARKS CANADA © ROM (2); D.W. MILLER, SI

mens, scientists are better able to see similarities among animals, and so they are shifting their emphasis from unique to shared characteristics.

After a week of slim pickings at Walcott Quarry, Caron and his tired, sore team were ready to try a new location. "I'm looking forward to seeing a lot of new fossils in unexpected places," said the optimistic Caron. "One hundred years later, there are still a lot of questions, still a lot of discoveries to make!"

Caron climbed aboard a helicopter to scout nearby mountain peaks for new sites to explore in the future. He was joined by Robert Gaines, a Pomona College geologist who studies the shale millimeter by millimeter to figure out whether the various layers represent millennia of accumulated sediment or a few moments' worth deposited by storm currents. "We rely on Bob to read the book of the rocks," said Caron. From the chopper Gaines saw a number of promising spots. "I'm aroused, scientifically," he said. He was keen to get on the ground and get out his measuring tape.

The helicopter put down near Stanley Glacier, where Caron and Gaines joined the rest of the crew, who were already prospecting for fossils. It did not take long to hit pay dirt. On the first afternoon, Loxton found a fossil of a species fondly known as Creeposaurus (until it can be properly studied, identified and given its scientific name). Caron called out: "Champagne!" Only three other specimens of this tentacled, bottom-dwelling animal had ever been collected.

"Creeposaurus is a new species, but it's important for another reason as well," Caron explained. "It's helpful in understanding two animal lineages—one is like a starfish, an echinoderm, and the other is a plankton-like organism, a hemichordate. Creeposaurus may be a common ancestor and has the potential to unite these two animals that we know today."

The Stanley Glacier valley, which is shaped like an amphitheater, turned out to be the scene of a paleontological pageant. As the glacier melted, over the past few thousand years, it exposed a fresh outcrop of loose rock stretching for a mile and a half. "Extraordinary, amazing, to find so many animals here, lying around untouched from hundreds of millions of years ago," said Caron.

Over the next two weeks, he and his crew, occasionally using a diamond-bladed rock saw, would collect several hundred specimens, including what they believe to be four new species. One of them, an arthropod, was found in such profusion—appendages here, carapaces there—by so many crew members that it became a sort of site mascot the group dubbed "Stan Animal." "A very scary animal," Caron said of a specimen with spiky legs and multiple rows of teeth. "You don't want to have it in your sleeping bag at night."

After the end of the field season, Caron returned to the Royal Ontario Museum, where he swapped his worn and grubby hiking duds for laboratory whites. In the collections room, he flipped through a notebook, trying to make sense of the cans and crates full of rock that sat in a jumble at his feet. "It's a treasure chest waiting to be opened," he exulted.

ROBERT GAINES

New Burgess Shale-like deposits in Europe, Asia, Australia and North America (Caron at the Stanley Glacier site) are showing scientists the patterns of evolution.

SIOBHAN ROBERTS *lives in Toronto. She is the author of* King of Infinite Space.

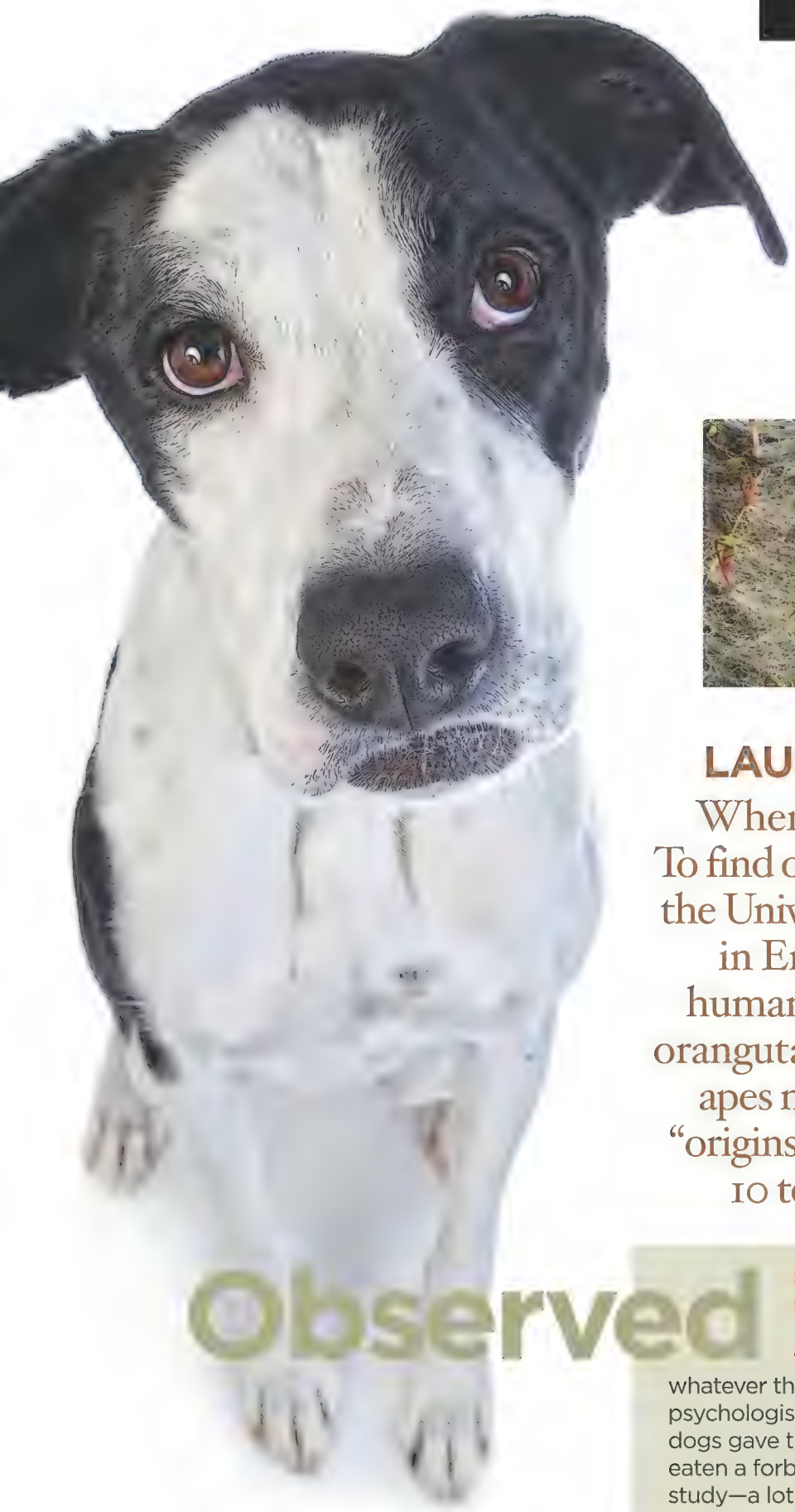
WILD THINGS

LIFE AS WE KNOW IT

BY JOSEPH CAPUTO, T.A. FRAIL, MEGAN GAMBINO, ASHLEY LUTHERN AND ABIGAIL TUCKER

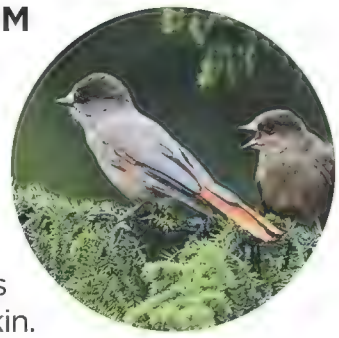
WHY SNAKES ARE SO GRIPPING

Exactly how does a snake slither across the ground? Scientists long assumed that the reptile pushed against rocks and branches to move forward. But that theory lacks legs, according to a new study. After watching snakes wriggle up rough fabric surfaces or (less successfully) smooth surfaces, scientists from New York University and elsewhere say the secret is in the scales. The belly scales are oriented so that they snag on irregularities. By pushing parts of their belly down to take advantage of this friction, the snakes have enough leverage to speed ahead.



Observed

AVIAN WARNING SYSTEM

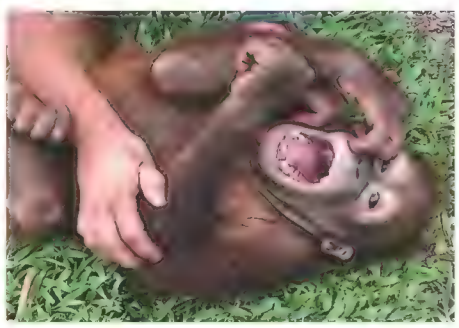


Siberian jays screech at a predator if it enters their territory. Now a researcher from Uppsala University in Sweden says the birds aren't just panicking. They use more than 25 different calls—more than any other known bird species—depending on what kind of predator (hawk or owl) is nearby, how big a risk it poses and whether birds listening nearby are kin.

NEW PLANT STRUCTURE

In the Caucasus Mountains, a Dutch and Russian team found a previously unknown type of plant structure. "Snow roots" (left) weave a foot or more through the snowpack, absorbing nitrogen trapped in the snow. *Corydalis conorhiza*—a member of the poppy family—has normal roots as well, but its snow roots give it a head start on the brief growing season.

LAUGH LIKE AN APE

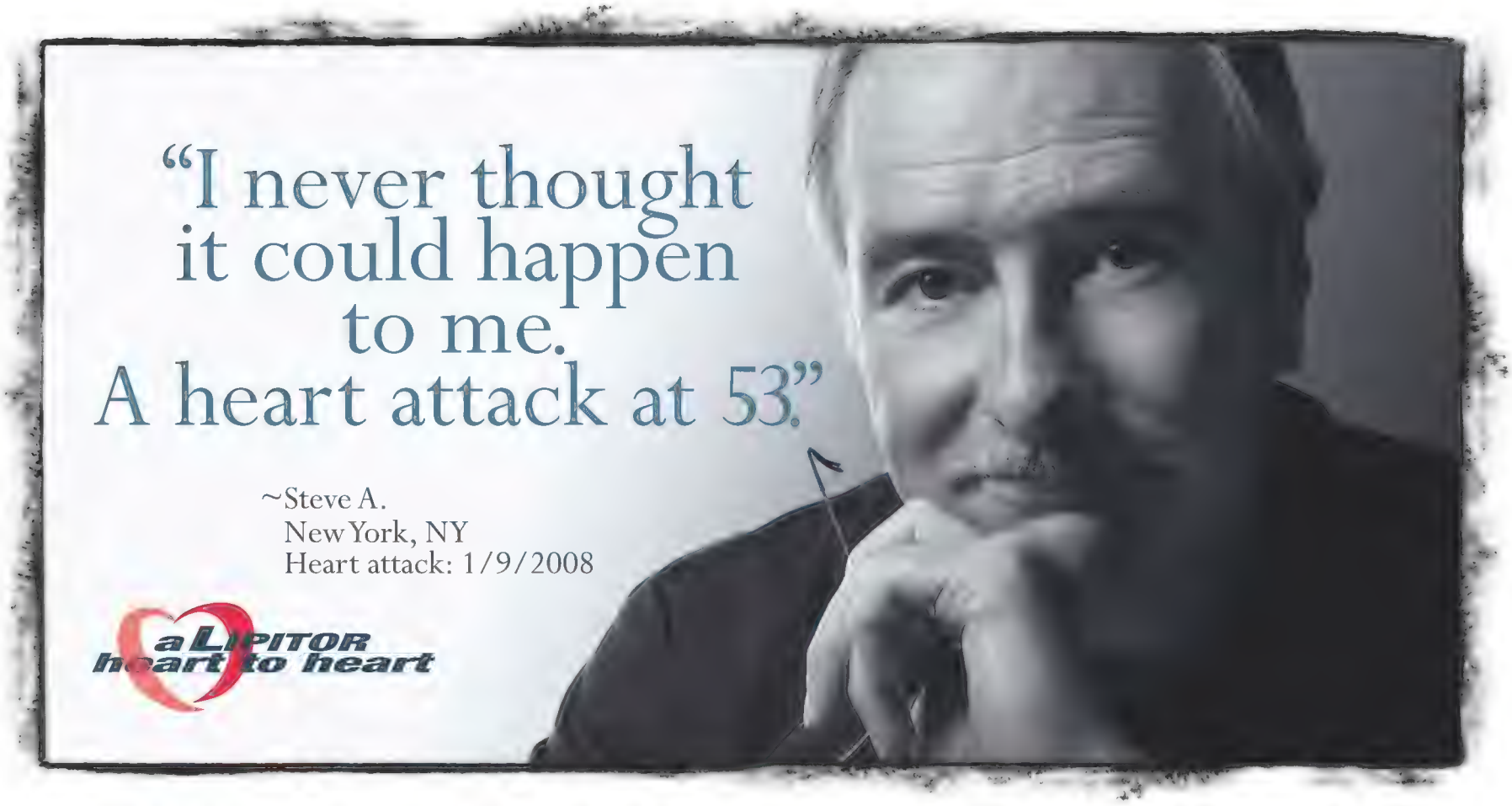


When did laughing begin? To find out, researchers led by the University of Portsmouth in England tickled young humans, chimps, bonobos, orangutans and gorillas. The sounds that these great apes made were so similar, the study concluded, the "origins of human laughter can be traced back at least 10 to 16 million years"—to our common ancestor.

NAME: The domestic dog, *Canis familiaris*.
LOOKS: Guilty (e.g., avoids eye contact, drops its tail, lies down, rolls onto its back, slinks off).
THINKS: Who knows? But a dog's guilty look is a reaction not to whatever the dog did, but to its owner's scolding, according to a study by psychologist Alexandra Horowitz of Barnard College. One telltale bit of data: dogs gave the guilty look when their owners mistakenly thought the dogs had eaten a forbidden treat, even when the dogs were completely innocent. More study—a lot more—is required to establish whether dogs have a conscience.

Listen to alarm calls from Siberian jays at Smithsonian.com/WildThings

DAVID HU / GEORGIA TECH; IDAMINI / ALAMY; PAAL HERMANSEN / NHPA / PHOTOSHOT; V.G. ONIPCHENKO; MIRIAM WESSELS / AP IMAGES



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*Patient's risk factors include age, gender, smoking, and high blood pressure.

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LIPITOR is not for everyone. It is not for those with liver problems. And it is not for women who are nursing, pregnant or may become pregnant. If you take LIPITOR, tell your doctor if you feel any new muscle pain or weakness. This could be a sign of rare but serious muscle side effects. Tell your doctor about all medications you take. This may help avoid serious drug interactions. Your doctor should do blood tests to check your liver function before and during treatment and may adjust your dose. The most common side effects are gas, constipation, stomach pain and heartburn. They tend to be mild and often go away.

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Please see additional important information on next page.

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- **Liver problems**. Your doctor may do blood tests to check your liver before you start LIPITOR and while you are taking it.

Symptoms of muscle or liver problems include:

- Unexplained muscle weakness or pain, especially if you have a fever or feel very tired
- Nausea, vomiting, or stomach pain
- Brown or dark-colored urine
- Feeling more tired than usual
- Your skin and the whites of your eyes turn yellow

If you have these symptoms, call your doctor right away.

The most common side effects of LIPITOR are:

- Headache
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- Rash
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- Upset stomach and stomach pain
- Muscle and joint pain

Side effects are usually mild and may go away by themselves. Fewer than 3 people out of 100 stopped taking LIPITOR because of side effects.

HOW TO TAKE LIPITOR

Do:

- Take LIPITOR as prescribed by your doctor.
- Try to eat heart-healthy foods while you take LIPITOR.
- Take LIPITOR at any time of day, with or without food.
- If you miss a dose, take it as soon as you remember. But if it has been more than 12 hours since your missed dose, wait. Take the next dose at your regular time.

Don't:

- Do not change or stop your dose before talking to your doctor.
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Around the Mall

SCENES AND SIGHTINGS FROM THE SMITHSONIAN MUSEUMS AND BEYOND

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STEPHEN VOSS

BAGGED AND TAGGED

ON A SMALL ISLAND NEAR WASHINGTON, D.C., SMITHSONIAN RESEARCHERS HAVE FOUND A GENETIC CODE THAT COULD REVOLUTIONIZE BOTANY

PAGE 23

"Now it's off to the races," botanist Dave Erickson says of a project to barcode 250 species of plant life on Plummers Island.

FROM THE CASTLE

Ways We Serve

G. WAYNE CLOUGH

WITH BOTH ENGINES DEAD due to bird strikes, Capt. "Sully" Sullenberger had to act fast. Four minutes later, he safely landed US Airways Flight 1549 in the Hudson River. Crash investigators quickly delivered bird remains found in the engines to the Smithsonian Feather Identification Laboratory, which handles nearly 4,500 bird-strike cases annually for the FAA and the military. The identification: Canada goose (*Branta canadensis*). Isotopic analysis of the feathers by our Migratory Bird Center determined that the geese were migratory. Such details help design improved strategies to reduce bird strikes. Smithsonian scientists are often called upon for help by the FBI and other government agencies. Our physical anthropologists regularly identify crime and disaster victims, such as those from the 9/11 Pentagon attack and the Bosnian conflict. Smithsonian entomologists, working with our collection of 12 million beetles, are helping the Agriculture Department combat a "pine bark" beetle disease killing America's conifers. At the National Zoo's Conservation and Research Center, reproductive biologists recently celebrated the births of two critically endangered clouded leopards, 38 black-footed ferrets and the hatching of North America's most genetically valuable white-naped crane.

The Smithsonian's Feather Identification Laboratory (above right) quickly determined that Canada geese had disabled US Airways Flight 1549 (above left: in the Hudson).

The Smithsonian also plays key roles in long-term monitoring initiatives addressing global warming, invasive species, loss of biological and cultural diversity and deteriorating art. Annually a thousand scientists and students conduct research at the Smithsonian Tropical Research Institute's observational sites. The Smithsonian Environmental Research Center (SERC) offers researchers and conservation officials an invaluable 30-year database on fish and invertebrate population dynamics in the upper Chesapeake Bay. SERC is also the home of the National Ballast Information Clearinghouse and works with University of Maryland scientists to reduce the introduction of invasive species into U.S. waters through ballast water on incoming ships.

At the Smithsonian American Art Museum, the Save Outdoor Sculpture! (SOS!) program has enlisted local volunteers to document the history and condition of outdoor sculptures across the country. More than half of the 32,000 sculptures surveyed need conservation or maintenance. After Hurricane Katrina, the program provided lists of sculptures to five Gulf states' historic preservation offices to help them assess damage. In these and many other ways, the Smithsonian serves our nation—and our world.

G. WAYNE CLOUGH *is Secretary of the Smithsonian Institution.*

Smithsonian Institution

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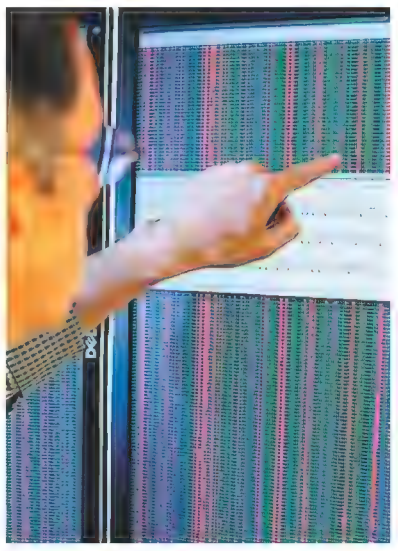
CRACKING THE CODE

EVERY FORM OF LIFE HAS A UNIQUE DNA BARCODE. THE TRICK IS FINDING IT

THE EXPEDITION TEAM didn't expect the water to be so high or the final stretch of the planned route across a narrow channel impassable. The scientists have to scramble across a crude bridge of downed branches to get to the island's southeastern tip and begin collecting specimens.

"Essentially, we're standing in a tropical forest," says botanist John Kress. In the muggy heat, he's rolled up the sleeves of his white dress shirt. He grabs a small tree branch and brings its burgundy flowers into closer view. "I feel like I'm in Costa Rica," he says.



A high-pitched whistle emerges from the forest. Kress' colleague, botanist Dave Erickson, jokingly asks if it's a howler monkey, which lives in Central and South America.

"It's whatever you want it to be," says Kress.

Plummers Island, a 12-acre, teardrop-shaped landmass in the Potomac River—just over ten miles from Kress' office at the Smithsonian National Museum of Natural History—is about as unspoiled, and unlikely, a landscape as can be found inside the Washington, D.C. Beltway. Owned by the National Park Service since 1961, Plummers is also the most thoroughly studied island in North America. And, thanks to Kress and his colleagues, it is the first site in the world to have all 250 of its plant species barcoded.

DNA barcoding, the brainchild of Canadian geneticist Paul Hebert, is modeled after the Universal Product Code (UPC) found on consumer packaging. Each UPC has a number designating the manufacturer (say, a soft drink company) and a specific product identifier (diet, caffeine-free, etc.). Hebert found a segment of animal DNA common to all species (the manufacturing code) and varied enough to distinguish among animal species (the product identifier). But researchers have had a harder time finding a standardized DNA segment for plant life.

Starting five years ago, Kress' research team collected samples of every plant species on Plummers Island. Then, in a botany lab, Erickson and others determined each one's DNA sequence. From there, they homed in on three genetic zones—two genes and an "intergenic spacer" between genes—that collectively could distinguish the plants. Along

Botanists John Kress and Dave Erickson (above: from left) have spent five years collecting and barcoding DNA sequences (left: in Erickson's lab) of Plummers Island's 250 plant species.

with other botanists, Kress and Erickson are in the midst of a formal process to get the markers approved as the standard plant barcode. Kress is hoping for official acceptance within a year from the Consortium for the Barcode of Life, a project established in 2004 to compile a reference library of codes.

Until recently, taxonomists needed a plant's flowers or fruits to classify it, meaning they had to collect samples at specific times of the year. But with DNA barcoding, they can use any part of the plant—seeds, bark, roots or leaves—to identify it.

"But the biggest benefit is that you won't have to be an expert," says Kress. In the not-so-distant future, even schoolchildren will be able to identify plants with hand-held DNA sequencers. They could then upload the barcodes via smartphones to an online encyclopedia with basics about the species, botanical art and anecdotal information. The Food and Drug Administration could use barcoding to test herbal supplements; U.S. Customs and Border Protection could use it to identify suspicious imports.

Erickson has also found plant DNA in the ground-up guts of ten different orders of insects from Plummers Island. He wants to better understand which insects are specialists, meaning they eat certain plant species, and which are generalists, which eat just about anything.

"I'm a find 'em and grind 'em kind of guy," says Erickson, turning a common botanical slur into a boast. Kress, a vegetarian, rolls his eyes in feigned disgust.

"You're definitely not a specialist," Erickson teases, dropping a bright green caterpillar into a tiny specimen bag. "You're a generalist. I've seen you eat." MEGAN GAMBINO

STEPHEN VOSS (2)

THE OBJECT AT HAND

Lunar Module

NATIONAL AIR AND SPACE MUSEUM

ONE GIANT LEAP

The ingenious lander enabled men to walk on the moon

BY OWEN EDWARDS

THE *EAGLE* LANDED on July 20, 1969. For those who watched the *Apollo 11* astronauts park their lunar lander on Tranquility Base—in my case, on a grainy black-and-white television in a small house in the hills above Los Angeles—the fact that Neil Armstrong's "one giant leap for mankind" took place 40 years ago can only come as a shock. Slowly down the ladder went the first human being to step onto the moon, clumsy in his spacesuit, and we knew we were witnessing a moment we would never forget.

The lunar module that transported Armstrong and Buzz Aldrin to the gritty surface of the moon was a two-section invention built by the Grumman Corporation. The bottom unit consisted essentially of four landing struts equipped with a retrorocket to cushion the descent. It would remain on the moon after the upper section, also rocket-propelled, carried the astronauts back to the command module, piloted by Michael Collins.

In five subsequent lunar landings, the same type of craft would be used to deliver ten astronauts from command modules to the moon. All the landers were left behind, the bases remaining where they touched down. After astronauts returned to the modules, they jettisoned the transport capsules, which crashed into the moon or vanished into space.

Today, lunar lander LM-2 ("LM" is shorthand for Lunar Excursion Module) remains earthbound—a 40-year-old vehicle that never got off the launchpad. It is on display at the Smithsonian's National Air and Space Museum (NASM) in Washington, D.C.

Transporting the *Eagle* astronauts safely to the moon was the result of a remarkable series of test flights that had begun in 1968 with the earth-orbiting *Apollo 7*. Early on, NASA planners made the decision to land on the moon from an orbiting craft rather than going directly from earth to the lunar surface. Grumman's solution—a lander with ingenious dual-section construction for separate descent and ascent functions—would prove to be one of the most reliable elements in the Apollo program.

The first lander, LM-1, went into earth orbit on a Saturn rocket on January 22, 1968, for unmanned testing of its propulsion systems. (LM-1 was not intended to return to earth.) The LM-2 was designed for a second unmanned test, but because the first went off without a hitch, another was deemed unnecessary. According to NASM scientist Robert Craddock, the two landers were not designed to be "man-ready"; they lacked safety equipment and other fittings necessary to accommodate astronauts.

During an emergency, a lander, equipped with additional sources of power and propulsion, could also serve

CONTINUED ON PAGE 26

Although the lander may appear "flimsy and gangly," says NASM curator Allan Needell, the craft represents "a very pure design built for a very specific mission."

MARK AVINO / NASM, SI

Revisit the *Apollo 11* moon mission at Smithsonian.com/lunarlander

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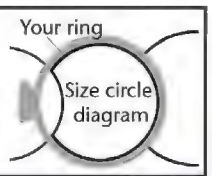

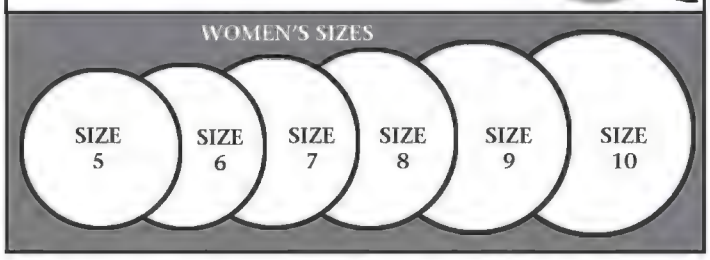

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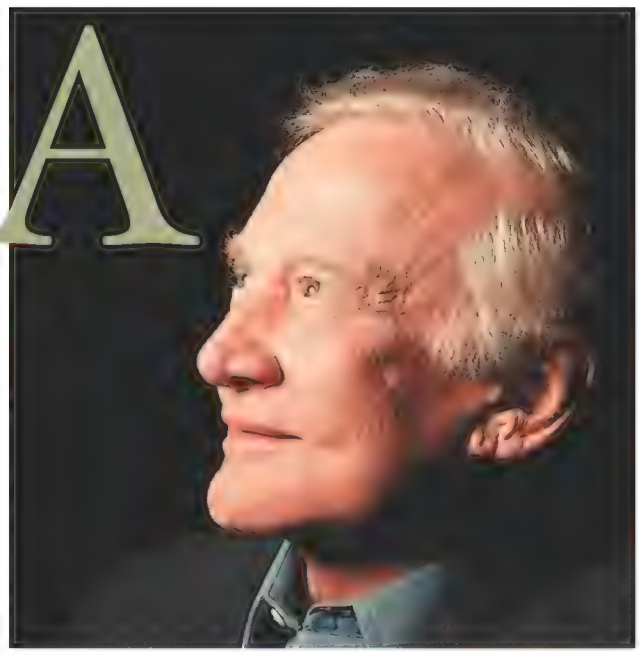


BUZZ ALDRIN, 79, the second man to walk on the moon, recently published *Magnificent Desolation*, his memoir about his life since the 1969 lunar landing. He spoke with the magazine's Joseph Caputo.

LOOKING BACK, HOW WOULD YOU HAVE CHANGED THE LUNAR MODULE? It did what it was supposed to do. Maybe we could have put the antennas in better places, but they all eventually worked. It was just amazing how much deployable cargo we were able to stow in the descent stage. The ascent stage looked ugly, but it didn't need to be smooth and shiny-looking. It needed to function in a vacuum, and it got the job done.

WHAT WERE YOUR MOST MEMORABLE MOMENTS IN THE LUNAR MODULE? The 11 minutes of powered descent to the lunar surface. That was the pioneering effort we'd been preparing for: putting together the analysis of what we needed in terms of navigation, thrust, control, autopilot and communications. We had to be able to smoothly execute that maneuver and simultaneously retain the option to abort at any time and return to orbit.

DO YOU THINK THE UNITED STATES SHOULD BE PLANNING A RETURN TO THE MOON? I don't think we should send humans unless they engage in some sort of commercial activity that could help defray the very large cost of living in an environment as hostile as the moon. In the meantime, we should be charting a clear pathway that will increase our capabilities: developing better spacecraft and communication technologies, finding ways to protect ourselves against long-duration radiation effects and bone and muscle deterioration.

The crew of the *Apollo 11* mission, from left: mission commander Neil Armstrong, command module pilot Michael Collins and lunar module pilot Buzz Aldrin.

WHAT ARE THE TAKE-AWAY LESSONS? We need to focus on how best to make the transition from the space shuttle to the space station to space exploration. Otherwise, we end up with a gap that's difficult to fill. We didn't have a gap between the Mercury and Apollo programs because we put in an interim program—Gemini—that really made Apollo possible. But we didn't follow up very well. We could have used both Skylabs as a platform for further exploration, instead of putting the backup in the Smithsonian National Air and Space Museum.

CONTINUED FROM PAGE 24

as a kind of space lifeboat for astronauts. This is just what happened on the ill-fated *Apollo 13* mission in April 1970. As its crew hurtled toward the moon, an oxygen tank exploded, causing damage that knocked out much of the crew's air, electrical and water supplies. The astronauts climbed through a hatch from the command module into the contiguous lander. The lander's rockets supplied the boost needed to guide the space capsule accurately around the moon and back toward earth.

Because landers were designed to be used only in space—not to withstand re-entry into earth's atmosphere—engineers had no need to factor atmospheric friction into their design. Thus, says NASM curator Allan Needell, "the lunar module looks flimsy and gangly—it's a very pure design built for a very specific mission." Every astronaut who went to the moon, he adds, has visited the LM-2 at NASM. "It's obviously the best place for television interviews," he says. "They all think that the lunar module was one of the really unique engineering achievements of the Apollo program."

The LM-2 was built for Earth-orbit tests, not engineered to touch down on the moon; it had to be retrofitted with landing gear in order to replicate the appearance of the Armstrong-Aldrin craft. It has also been recently restored. Its deteriorated gold-tone Mylar sheathing on the descent section and landing struts has been replaced, with extra layers added to recreate the appearance of *Apollo 11*.

Today, visitors to the *Apollo* exhibition witness an artifact that looks—with a little help from artful curators—much as *Eagle* looked when it made that giant leap 40 years ago. When Buzz Aldrin radioed back to us riveted earthlings that "this stands as a symbol of the insatiable curiosity of all mankind to explore the unknown," he was talking about the overall mission. But he might as easily have been referring to the ungainly marvel that made it possible.

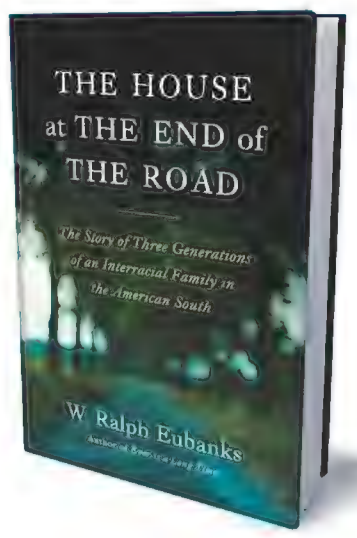
OWEN EDWARDS *is a freelance writer and author of the book* Elegant Solutions.

DAMIAN DOVARGANES / AP IMAGES; NASA

What's Up

FINE HANDIWORK

The Renwick Gallery honors craft artists such as Mary Van Cline, who imbues her glasswork with black-and-white photographs (below: *Cycles of Relationship of Time*, 2000). The exhibit runs through January 3.

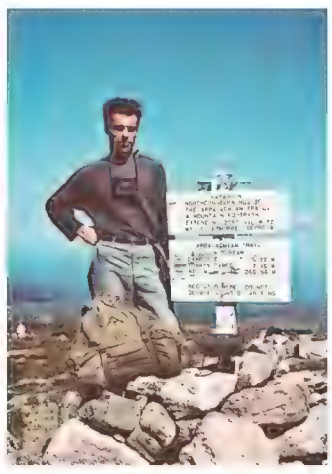

THE HOUSE at THE END of THE ROAD
The Story of Three Generations of an Interracial Family in the American South
W. Ralph Eubanks

LOVE CONQUERS

In 1914, a young white man wed a light-skinned black woman and built a home in southern Alabama. In *The House at the End of the Road* (Smithsonian Books, 2009), W. Ralph Eubanks shares his grandparents' experiences as an interracial couple during the Jim Crow era.

SKETCH ARTIST

Annie Pootoogook chronicles Inuit life with stark line drawings (right: *Holding Boots*, 2004). Her sketches are at the National Museum of the American Indian in New York City until January 10.



TRAILBLAZER

Hike over to the National Museum of American History where, through October 11, you can view photographs and diaries of naturalist Earl Shaffer (left), who, in 1948, made the first continuous trek of the entire Appalachian Trail—from Georgia to Maine in 124 days.

WALLPAPERS

"Works on paper" is the theme for the American Art Museum's exhibit on graphic masters, through January 10 (right: *Untitled*, by David Smith, 1951).

BY JOSEPH CAPUTO

VISIT THE SMITHSONIAN For a free Associates' planning packet, call 202 633-1000 or 202 357-1729 (TTY), 9 a.m. to 5 p.m. Monday through Friday and 9 a.m. to 4 p.m. Saturday. Or send an e-mail to info@si.edu. The Smithsonian Information Center in the Castle is open daily, 8:30 a.m. to 5:30 p.m. Members can visit the reception desk between 9 a.m. and 4 p.m. to register for a behind-the-scenes tour and to hear about membership benefits. Most museums are open daily, 10 a.m. to 5:30 p.m. All museums are closed December 25.

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Smithsonian
AUGUST 2009 · VOLUME 40, NUMBER 5

RIVER OF

The Cahaba, an unsung Alabama waterway, turns out to b

RICHES

be one of the most biologically diverse places in the nation

BY MICHELLE NIJHUIS

PHOTOGRAPHS BY BETH MAYNOR YOUNG

The 190-mile-long Cahaba River is home to many rare species, some of which were thought to be extinct. The showy Cahaba lily (at Halfmile Shoals) thrives in clean, clear, rapidly flowing water.

Randy Haddock stands on a muddy riverbank

in central Alabama, looking over his favorite place on earth. Haddock, a slight, spectacled biologist with a trim beard, smiles as he hoists a canoe over his head, carries it to the water and launches it almost soundlessly into a calm stretch of the Cahaba River.

Between brilliant-green margins of broad-leaved trees, the Cahaba flows from its headwaters near Springville through the suburbs of Birmingham and into the heart of the state. The river slips southward with barely a murmur, unnoticed by many who live nearby. But Haddock, who has plied it for 20 years, knows the Cahaba as one of the grandest places in North America.

Biological splendor is usually associated with faraway places and fabulous creatures, rain forest river basins or African elephants. The close-to-home grandeur of the Cahaba is more subtle, counted not in jaguars or monkeys but in snails and mussels. To those willing to look closely, though, the river is as fascinating as any jungle.

The Cahaba boasts the longest free-flowing stretch of river in Alabama—140 miles—and one of the longest in the Southeast. Biologists have found that it shelters more fish species per mile than any other river in the country. Its floral attractions range from a spectacularly showy lily to a low, unassuming prairie clover, one of several local plant species that, until recently, were entirely unknown to science.

"I keep seeing things I've never seen before, so I feel compelled to keep learning," says Haddock, as he dips his paddle in the water and sets off downstream. "The Cahaba is different every time."

This overcast spring morning, our quarry is big botanical game. The river stretches ahead of our canoes in a long, silent pool, a promising sign for our small group of lily hunters. "The bigger the pool, the bigger the shoal," Haddock says. Shoals—rocky bars that reach across the river—trap lily seeds as they tumble downstream and shelter them as they sprout.

The river bends, and Haddock hears water babbling ahead. Moments later, the lilies loom into view, their bushel-size bunches arrayed in rows, their papery, moon-faced flowers forming a frothy fence. Our group falls quiet. Some of us are seeing the lilies for the first time, some for the hundredth, but the sudden expanse of blooms silences even the veterans.

As our canoes float into the rocky shoal, the lilies seem to engulf us, the giant pale flowers reaching to our chins. Though the Cahaba lily, also known as the shoals spiderlily, once grew throughout the Southeast, it's now restricted to about 70 stands. A quarter of the stands are in the Cahaba River, and one of the densest and largest is found here. Their display is as fleeting as it is rare. The lilies begin to bloom on the Cahaba in May, with each flower opening in the evening and lasting but a single day. The entire spectacle is over by mid-June.

Botanists have praised the flower's beauty for centuries: "nothing in vegetable nature was more pleasing," wrote itinerant naturalist William Bartram, who explored the Southeast just before and during the American Revolution. But few had studied the flowers, and questions remained about their basic biology.

Haddock, trained as an ecologist, moved to Birmingham in 1988 for a medical-research job at the University of Alabama and volunteered to lead canoe tours for the Cahaba River Society in his spare time. Though no one knew exactly why the flowers opened at night, Haddock suspected a nocturnal pollinator and decided to test his hunch.

One May evening, Haddock paddled out to a shoal and settled in among the lilies. He waited through one night and into the next, until finally he saw something flitting from flower to flower. Luckily, the pollinator then flew close enough to Haddock for him to identify it as a sphinx moth—solving one of the Cahaba River's many long-standing mysteries.

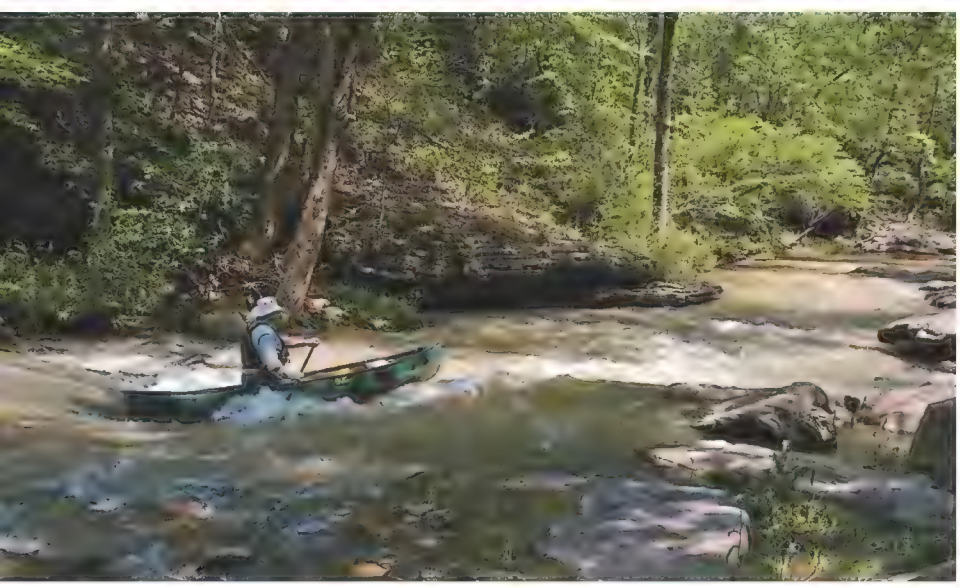
Haddock is still plumbing the Cahaba's secrets. He pauses near an especially dense stand of lilies, clambers out of his canoe and picks his way over the rocks until he finds a Cahaba pebblesnail, no larger than a ball bearing.

Until a few years ago, this snail was thought to be extinct, just one more species lost to the wave of extinctions on Southeastern rivers. Plant and animal species took refuge in the region during the last ice age, when glaciers covered the north, then thrived and diversified for millennia in the region's wet, warm climate. But as rivers were dammed for hydropower and transportation over the past century, species began to blink out.

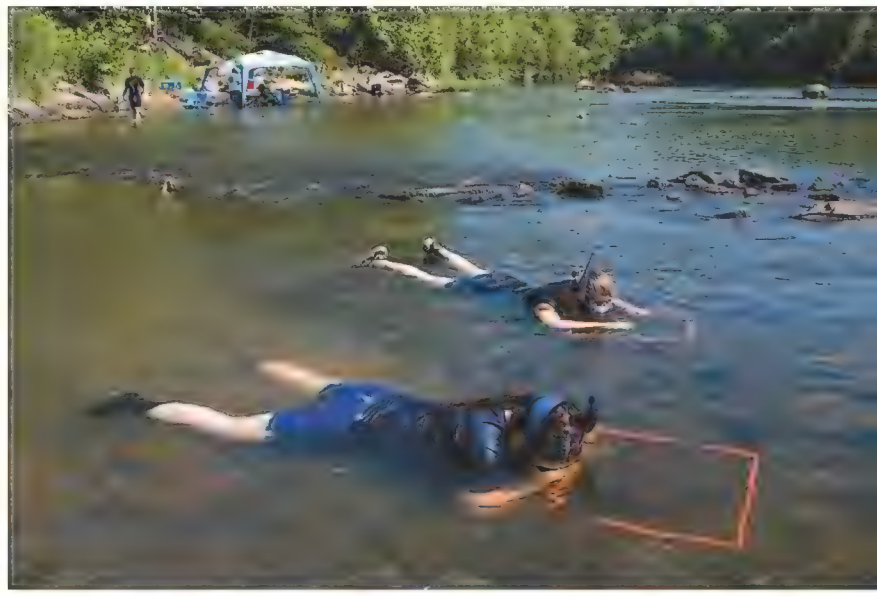
The region's lush rivers—which the eminent biologist and Alabama native E. O. Wilson calls an "aquatic treasure house"—continue to lose species. Alabama now leads the lower 48 in extinctions, due mostly to disappearances among its freshwater fauna: the Coosa River, which runs alongside the Cahaba a few dozen miles to the east, lost 34 species of snails—half its entire inventory—in the 50 years between 1914 and 1964. This is considered by many experts to be the largest recent extinction event of any kind in the United States.

MAP: GUILBERT GATES

"Nothing in vegetable nature was more pleasing," wrote a Revolutionary War-era botanist of the rare Cahaba lily (below). Biologist Randy Haddock (left: netting insects and right: with an endangered cylindrical lioplax snail) figured out what pollinates the lilies, which bloom for a single night and day. Downstream of rapids (bottom left), the town of West Blocton crowns a Cahaba Lily Queen (bottom right) each May.



The Cahaba is a case study in the amount of time necessary for a waterway to recover after a blockage is removed. (Left: the Marvel Slab was destroyed in 2004; right: a snail and mussel inventory on the site in 2008.) More species of fish swim in the Cahaba per mile than in any other U.S. river. (Below: Paul Freeman, in orange shirt, and Randy Haddock net fish for a study; bottom left: a pregnant mussel; bottom right: a speckled darter.)



The Cahaba, too, has suffered casualties. Because of water pollution and other stresses such as sediment from erosion, almost a quarter of its original complement of mussel species has disappeared, and snails and fish are thought to have experienced similar declines. But the Cahaba, only 190 miles long, has also held on to a remarkable number of its native plants and animals—including 13 species of snails found nowhere else in the world, among them the humble Cahaba pebblesnail. In 2004, a visiting Australian biologist discovered that the snail thought to be extinct was simply hiding on the underside of rocks, where no one had bothered to look.

Several years ago, a Georgia botanist named Jim Allison identified eight previously unknown flower species along the river, an almost unheard-of haul in contemporary North America. The plants grow on a rare type of magnesium-rich rocky soil. Further investigation turned up eight more species never before found in the state, including one not seen anywhere since the 1830s. The Cahaba River's allies feel certain that more biological treasures lie in the glades, oxbows and shoals—all just waiting for someone to study them.

Such discoveries—and rediscoveries—are worth celebrating, say Haddock and other biologists. Snails and mollusks may not inspire us like bald eagles or blue whales or, for that matter, the flashy Cahaba lily. But they form the bedrock of healthy ecosystems, maintaining water quality by eating algae, feeding ducks, fish, crayfish and turtles, and, through their sensitivity to pollution, serving as early indicators of environmental trouble. "For these river systems in the Southeast, they are the keystone species," says Paul Johnson, program supervisor of the Alabama Aquatic Biodiversity Center.

The Cahaba paintbrush was found by a botanist in 1992.

When local game warden Ricky LeCroix buzzes up to the shoal in his airboat to say hello, Haddock is holding a tiny endangered snail called a cylindrical lioplax—and is engaged in an earnest lecture on snail sex. Some snails are both male and female, Haddock explains. But since the lioplax has separate sexes, it must work harder to find a mate in order to reproduce.

"Yeah," drawls LeCroix. "And when you only move six inches a year, you sure can't play hard to get."

BUT THE CAHABA IS MORE THAN a museum of rare Southeastern river species. It also serves as a laboratory for their recovery, thanks to the recent demolition of the Marvel Slab, a road crossing built in the 1960s as a shortcut across the river for coal trucks. Though a row of small culverts allowed water to flow through the structure, it acted like a dam and changed the speed of the current, destroying snail and mussel habitats and blocking fish as they tried to swim upstream to spawning grounds.

"You'd see schools of fish literally banging their snouts on the face of the dam, trying to travel upstream," says Paul Freeman, an aquatic ecologist for the Alabama chapter of the Nature Conservancy. Once a popular angling spot, the area upstream of the Marvel Slab had lost most of its fish population.

Throughout the country, small, outdated dams and other river barriers like the Marvel Slab are coming down. Many are no longer needed for their original purposes and have become safety hazards, environmental disasters or both. Their removal can jump-start river restoration and has yielded prompt and dramatic results in Maine, Florida, Arizona and elsewhere. But in Alabama, no dam had ever been removed for environmental reasons. Freeman and other supporters of the idea spent five years politicking in local communities and collecting the necessary bureaucratic approvals.

In 2004, the federal Army Corps of Engineers—the agency with authority over the Marvel Slab—and a host of other private and public agencies finally got the go-ahead. Biologists in wet suits and waders, armed with nets and plastic buckets, spent three days moving more than 12,000 snails and mussels out of the way, then donned hard hats to watch the removal of the slab. Though "all the guys really wanted to blow up the dam," says Wendy Smith of the World Wildlife Fund, construction experts recommended it be picked apart with a heavy-duty jackhammer. Doing so uncorked the longest free-flowing stretch of river in Alabama.

The results were dramatic. "The fish came back within hours, and the snails came back within days," says Freeman. Each summer since, Freeman and his colleagues have snorkeled at the former slab site, counting snails and mussels. In the past two years, the crew found as many as 2,000 snails per square meter in some places, up from only a handful or none at all before the removal. They have also documented a jump in native mussels. "Life rebounds pretty quickly when you give it a chance," says Freeman.

After discussions with Freeman and other biologists, officials from the Army Corps recently agreed to change the management of the two remaining river barriers between Birmingham and the Gulf of Mexico. This past spring, the Corps began opening and closing the locks on the Alabama River on a schedule designed to allow more native migratory fish to return to the Alabama and Cahaba rivers.

That could help a fish that is one of the rarest vertebrates in North America: the Alabama sturgeon, which resembles a small shark with whiskers and was once found in rivers throughout the area. In the spring of 2007, biologists were thrilled to find a lone sturgeon on the Alabama, the first seen in nearly seven years. They hoped it was a female,

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MICHELLE NIJHUIS *has written about aspen trees and Walden Pond for* SMITHSONIAN. **BETH MAYNOR YOUNG***'s photographs appear in* Headwaters: A Journey on Alabama Rivers.

The Cahaba River meets the Alabama River at the former state capital of Old Cahawba (far right: a fishing cottage built in the 1920s among the ruins of the 1820s capital). Freed slaves settled here after the Civil War, and major civil rights battles took place nearby. Today the Cahaba is a favorite spot for birders (left: a great egret amid Spanish moss; right: a great blue heron), especially the oxbows of Perry Lakes Park (below).

See more images of the Cahaba River at Smithsonian.com/Cahaba

which they would be able to breed using stored sturgeon sperm, but it turned out to be a male. The biologists implanted a tag in it and released it back into the Alabama, where it lives today—one of the last of its kind.

BELOW THE MARVEL SLAB SITE, the Cahaba continues its course southward toward the Alabama River. Its murmurs grow even quieter and its bends more generous, looping over the coastal plain. Cypress trees, their fluted buttresses punctuated with knobby "knees," line its banks, and the air fairly sags with moisture. Here, old river oxbows become steaming swamps, hung with Spanish moss and home to carnivorous plants and the occasional alligator.

This tropical stretch, far from Birmingham and other cities, is even less traveled than the lily shoals, and even experienced canoeists and anglers can trip up on the unknown. On one of his first dates with his future wife, Shannon, Haddock suggested an exploration of the Oakmulgee, a Cahaba tributary. The stream turned out to be so overgrown and littered with fallen logs that the pair traveled in circles, managing to escape only after a marathon bushwhack. "I couldn't believe she was still speaking to me the next day," Haddock says.

Like the rest of the river, the lower Cahaba burgeons with diversity. Fish dart underneath canoes, and a few handfuls of river mud can contain a foot-long washboard mussel or a tiny, delicately striped fawn's foot mussel. Fish throughout the Southeast have endearingly quirky common names, and those here are no exception. "There's a frecklebelly madtom, a freckled madtom, a speckled madtom, a speckled darter and a freckled darter," Haddock singsongs. "But there's no frecklebelly darter."

The lower Cahaba also winds through history. It passes near the Edmund Pettus Bridge, which crosses the Alabama in Selma and is infamous as the site of a 1965 clash between police officers and unarmed civil rights demonstrators. The Cahaba ends at the remains of Old Cahawba, the state's first permanent capital. During the cotton boom on the surrounding prairies, Cahawbans built fine mansions—including the then-largest in the state—on broad streets named Mulberry, Pine, Oak and Chestnut. Ferries operated on both the Cahaba and Alabama rivers, and in the wet season, even steamboats made their way up to the Cahaba Valley.

But in the 1820s, the state capital moved to Tuscaloosa; after the Civil War, the county seat moved to nearby Selma, and residents followed, many dismantling and moving their elegant houses. The town site became a refuge for freed slaves and, in more modern times, an overgrown patchwork of fishing and hunting camps.

Today, Old Cahawba is a state historical site, a nature reserve and a ghostly place. The chinaberry-lined streets are dotted with ruins, filled with legends of shootouts and panther sightings, and silent but for the chatter of birds and insects. Under a high, wooded riverbank, near the red-brick columns of a former Old Cahawba mansion, the placid Cahaba meets the much larger Alabama, and flows quietly toward the sea.

Herod (right: in an 1856 painting by Giuseppe Fattori) built an elaborate palace fortress on the 300-foot mountain, Herodium, to commemorate his victory in a crucial battle. It was there that he vowed to be buried.

Finding Herod's Tomb

Archaeologists and treasure hunters had long scoured a mountain outside Jerusalem for the biblical king's resting place. Ehud Netzer is certain he has found it—mere steps from where he stood decades before

BY BARBARA KREIGER

SHIELDING MY EYES FROM THE GLARE of the morning sun, I look toward the horizon and the small mountain that is my destination: Herodium, site of the fortified palace of King Herod the Great. I'm about seven miles south of Jerusalem, not far from the birthplace of the biblical prophet Amos, who declared: "Let justice stream forth like water." Herod's reign over Judea from 37 to 4 B.C. is not remembered for justice but for its indiscriminate cruelty. His most notorious act was the murder of all male infants in Bethlehem to prevent the fulfillment of a prophecy heralding the birth of the Messiah. There is no record of the decree other than the Gospel of Matthew, and biblical scholars debate whether it actually took place, but the story is in keeping with a man who arranged the murders of, among others, three of his own sons and a beloved wife.

Long an object of scholarly as well as popular fascination, Herodium, also called Herodion, was first positively identified in 1838 by the American scholar Edward Robinson, who had a knack for locating biblical landmarks. After scaling the mountain and comparing his observations with those of the first century Jewish-Roman historian Flavius Josephus, Robinson concluded that "all these particulars . . . leave scarcely a doubt, that this was Herodium, where the [Judean] tyrant sought his last repose." Robinson's observation was confirmed later that century by Conrad Schick, the famous German architect and archaeologist who conducted extensive surveys of Jerusalem and its nearby sites.

ARTE & IMMAGINI SRL / CORBIS; PP. 36-37 DUBY TAL / ALBATROSS / ISRAELIMAGES

But where precisely was the king entombed? At the summit of Herodium? At the base? Inside the mountain itself? Josephus didn't say. By the late 1800s, Herod's tomb had become one of biblical archaeology's most sought-after prizes. And for more than a century archaeologists scoured the site. Finally, in 2007, Ehud Netzer of Hebrew University announced that after 35 years of archaeological work he had found Herod's resting place. The news made headlines worldwide—"A New Discovery May Solve the Mystery of the Bible's Bloodiest Tyrant," trumpeted the *London Daily Mail*.

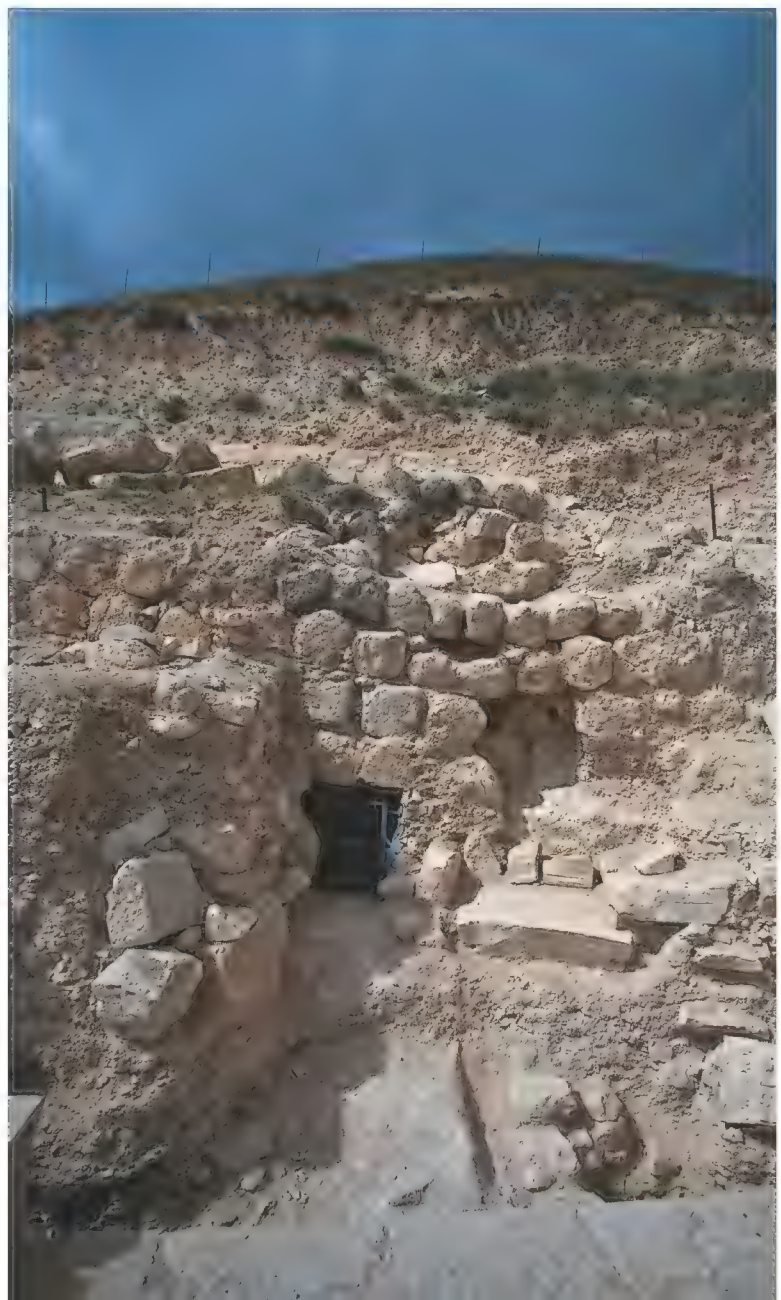
"In terms of size, quality of decoration and prominence of its position, it's hard to reach any other conclusion," says Jodi Magness, an archaeologist in the Department of Religious Studies at the University of North Carolina at Chapel Hill who has excavated at other sites where Herod oversaw construction projects. Ken Holum, a University of Maryland archaeologist and historian who served as a curator for the traveling Smithsonian exhibition "King Herod's Dream," cautions that "it is always wise to be less than certain when there is no identifying inscription or other explicit identification." But he says he personally believes Netzer has indeed discovered Herod's tomb.

Netzer, 75, is one of Israel's best-known archaeologists and a renowned authority on Herod. Trained as an architect, he

But where precisely was the king entombed? At the summit? At the base? Inside the mountain itself? The historical accounts didn't say.

worked as an assistant to the archaeologist Yigael Yadin, who from 1963 to 1965 led an exhaustive dig at Masada, the fortified plateau near the Dead Sea where Herod built two palaces. In 1976, Netzer led a team that discovered the site of one of Herod's infamous misdeeds: the murder of his young brother-in-law, Aristobulus, whom Herod ordered to be drowned in a pool at his winter palace complex near Jericho. Yet the discovery of Herod's tomb would be Netzer's most celebrated find. And as is often the case with such discoveries, Netzer found it where, for years, he least expected it.

ARRIVING AT HERODIUM, which is not only an active archaeological site but also, since the late 1960s, a national park, I drive partway up the mountain to the parking lot where I will meet Netzer. In the early 1980s, before the first intifada turned the West Bank into a conflict zone, Herodium drew some 250,000 people per year. For the moment I'm the sole visitor. At a kiosk I buy a ticket that lets me ascend on foot to



the summit. At the base of the mountain the remains of a royal complex, known as Lower Herodium, sprawl across nearly 40 acres. Gone are the homes, gardens and stables; the most recognizable structure is an immense pool, 220 by 150 feet, which is graced with a center island.

A narrow trail hugging the hillside leads me to an opening in the slope, where I enter an enormous cistern now part of a route to the summit, more than 300 feet above the surrounding countryside. The air inside is pleasantly cool, and the walls are smooth and dry, with patches of original plaster. I follow a network of tunnels dug during the second Jewish revolt against the Romans in A.D. 135 and enter another, smaller cistern. Daylight pours in. I climb a steep staircase and emerge at the summit, in the middle of the palace courtyard.

The palace fortress once reached close to 100 feet high and was surrounded by double concentric walls accented by four cardinal point towers. Besides living quarters, the upper palace had a triclinium (a Greco-Roman-style formal dining room lined on three sides by a couch) and a bathhouse that features a domed, hewn-stone ceiling with an oculus (round opening). It's strange to find such a perfectly preserved structure amid the ancient ruins, and it leaves me with an eerie sense of standing both in the past and the present.

Clockwise, from bottom left: Near the remains of the tomb, archaeologist Ehud Netzer found decorated red limestone fragments. After reassembling the pieces, he concluded they were part of a royal sarcophagus more than eight feet long. It once sat on a finely crafted podium made from smooth white ashlars (square stone).

Gazing out from the perimeter wall, I see Arab villages and Israeli settlements in three directions. But to the east cultivation abruptly stops as the desert exerts its authority, plummeting out of sight to the Dead Sea, then rising again as the mountains of Jordan. Why would Herod build such a prominent fortress—the largest palace complex in the Roman world—on the edge of a desert?

Though the site had little apparent strategic value, it held profound meaning for Herod. Born around 73 B.C., he was the governor of Galilee when, in 40 B.C., the Parthian Empire conquered Judea (then under Roman control) and named a new king, Mattathias Antigonus. Herod, probably more shrewd than loyal, declared allegiance to Rome and fled Jerusalem with as many as 5,000 people—his family and a contingent of fighting men—under cover of night.

Surging over rocky terrain, the wagon in which Herod's mother was riding overturned. Herod drew his sword and was on the verge of suicide when he saw she had survived.

DAVID SILVERMAN / GETTY IMAGES; GABI LARON / HEBREW UNIVERSITY INSTITUTE OF ARCHAEOLOGY; DORON NISSIM; GILA YUDKIN; MAP: GUILBERT GATES

He returned to the battle and fought "not like one that was in distress . . . but like one that was excellently prepared for war," Josephus wrote. In tribute to his victory and his mother's survival, he vowed to be buried there.

Herod sought refuge in Petra (in today's Jordan)—capital of the Nabateans, his mother's people—before heading to Rome. Three years later, with Rome's backing, Herod conquered Jerusalem and became king of Judea. A decade would pass before he would begin work on the remote fortified palace that would fulfill his pledge.

HEROD MUST HAVE GIVEN a lot of thought to how Herodium would function, given the lack of a reliable water source and the mountain's distance from Jerusalem (in those days, a three- to four-hour trip by horseback). He arranged for spring water to be brought three and a half miles via an aqueduct, relocated the district capital to Herodium (with all the staff that such a move implied) and surrounded himself with 10 to 20 trustworthy families.

"Herodium was built to solve the problem he himself created by making a commitment to be buried in the desert," says Netzer. "The solution was to build a large palace, a country club—a place of enjoyment and pleasure." The summit palace could be seen by Herod's subjects in Jerusalem, while the tallest of the four towers offered the king pleasant breezes and a gripping view of his domain.

Ongoing excavations by Netzer reveal the impressive variety of facilities that Herod built at his desert retreat, including a royal theater that accommodated some 450 spectators. Netzer believes it was constructed to entertain Marcus Agrippa, Rome's second in command and a close friend of the Judean king, who visited Herodium in 15 B.C. Netzer unlocks a plywood door that has been installed on the site and invites me into the royal box, where Herod and his honored guests would have been seated. The walls were decorated with vivid *secco* landscape paintings (colors applied to dry, not wet, plaster). The colors, though subdued now, still feel vibrant, and we gaze at the image of an animal, maybe a gazelle, loping along.

Around 10 B.C., according to Netzer, Herod oversaw the construction of his mausoleum. Upon its completion, he undertook the final stage of his self-commemoration by literally increasing the mountain's height: Herod's crew carted gravelly soil and rocks from the surrounding area to Herodium, pouring it all around the summit. Even with unlimited manpower, it must have been a Sisyphean enterprise to pile all that earth some 65 feet high and comb it over the original slopes like a child's carefully smoothed sand hill. "Like a pyramid," Netzer says, "the entire mountain was turned into a monument."

The borders of Judea were quiet during Herod's reign, enabling him to undertake an ambitious building program that brought employment and prosperity to the region. The major projects he completed include the incomparable Temple in Jerusalem, a stunning winter palace in Jericho, two palaces atop Masada and the harbor at Caesarea. A palace garden in Jericho was elevated so that people strolling along the colonnades would see the foliage and flowers at eye level.

Still, Herod's reign is remembered more for its ruthlessness and paranoia than its architectural feats. He tortured and killed family members, servants and bodyguards, to say nothing of his real enemies. In an Othello-like rage, Herod even ordered the execution of the woman he loved most—his second wife, Mariamne—believing that she had committed adultery. Herod's eldest son and heir apparent, Antipater, convinced the king that two of his other sons were plotting against him—so Herod had them executed. And when Herod learned that An-

Herod's mausoleum, as envisioned by Netzer (above and right), was located about halfway up the mountain. Netzer estimates that the mausoleum, constructed from *meleke* ("royal" stone), was as tall as a seven-story building.

BARBARA KREIGER *is the author of* The Dead Sea *and teaches creative writing at Dartmouth College.*

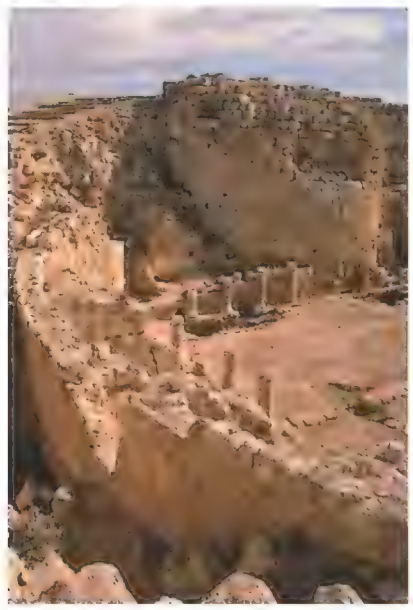
tipater was planning to poison him, he rose from his bed just five days before he died to order the murder of Antipater. (As the Roman Emperor Augustus supposedly quipped: "It's better to be Herod's pig than his son.") In a final act of depravity, Herod imprisoned all the notables of Judea, ordering that they be executed on the day of his death so the country would be plunged into mourning. But when Herod died, in Jericho at about age 69—probably of kidney failure exacerbated by a genital infection, according to Aryeh Kasher's recent biography *King Herod: A Persecuted Persecutor*—the prisoners were released. Instead of mourning, rejoicing filled the land.

Josephus wrote that Herod's body was conveyed to Herodium, "where, in accordance with the directions of the deceased, it was interred." The late king was "covered with purple; and a diadem was put upon his head, and a crown of gold above it, and a scepter in his right hand."

And so began a mystery that tantalized scholars for centuries.

IN THE 1860S, FELICIEN DE SAULCY, a French explorer, searched for Herod's tomb on the island in the center of the vast pool in Lower Herodium. Father Virgilio Corbo led an excavation at the summit from 1963 to 1967 on behalf of the Franciscan Faculty of Biblical Sciences and Archaeology in Rome. In 1983, a team led by Lambert Dolphin, a Silicon Valley geophysicist, used sonar and rock-penetrating radar to identify what Dolphin thought was a burial chamber inside the base of the highest tower on the mountaintop.

The summit palace could be seen by Herod's subjects in Jerusalem, while the tallest of the four towers offered the king a gripping view of his domain.



Some still believe that King Herod is buried in a secret chamber at the base of the palace's highest tower (above left). Felicien de Saulcy, a 19th-century French explorer, thought the tomb was located in an island at the center of a vast swimming pool (above right) at the foot of Herodium.

Netzer, however, did not find Dolphin's data convincing enough to redirect his efforts from other, more promising sites—notably a monumental building in the lower complex. Moreover, Netzer and others argue that entombment in the tower would have been unthinkable, because Jewish law proscribed burial within a living space. Barbara Burrell, a classics professor at the University of Cincinnati, wrote in 1999 that interring Herod inside the palace "would have horrified both Romans and Jews, neither of whom dined with their dead."

Netzer smiles as he recalls that when he investigated the cisterns and tunnels within Herodium in the early 1970s, he was actually standing less than ten feet from the tomb, which he later found halfway up the eastern slope. But Netzer instead continued to focus his attention on the foot of the mountain. "We kept getting hotter and hotter," says Ya'akov Kalman, one of Netzer's longtime associates, "but nothing came of it." Netzer believes that Herod originally intended to be buried in the lower complex, but for unknown reasons changed his mind and chose this other location. In 2005, having completed his

ILLUSTRATIONS: JOE MCKENDRY (BASED ON RECONSTRUCTIONS BY RACHEL CHACHY & MARCOS EDELCOOP); CHANANIA HERMAN / GPO / GETTY IMAGES; DUBY TAL / ALBATROSS / ISRAELIMAGES

work at Lower Herodium without revealing a burial chamber, Netzer turned once again to the mountain.

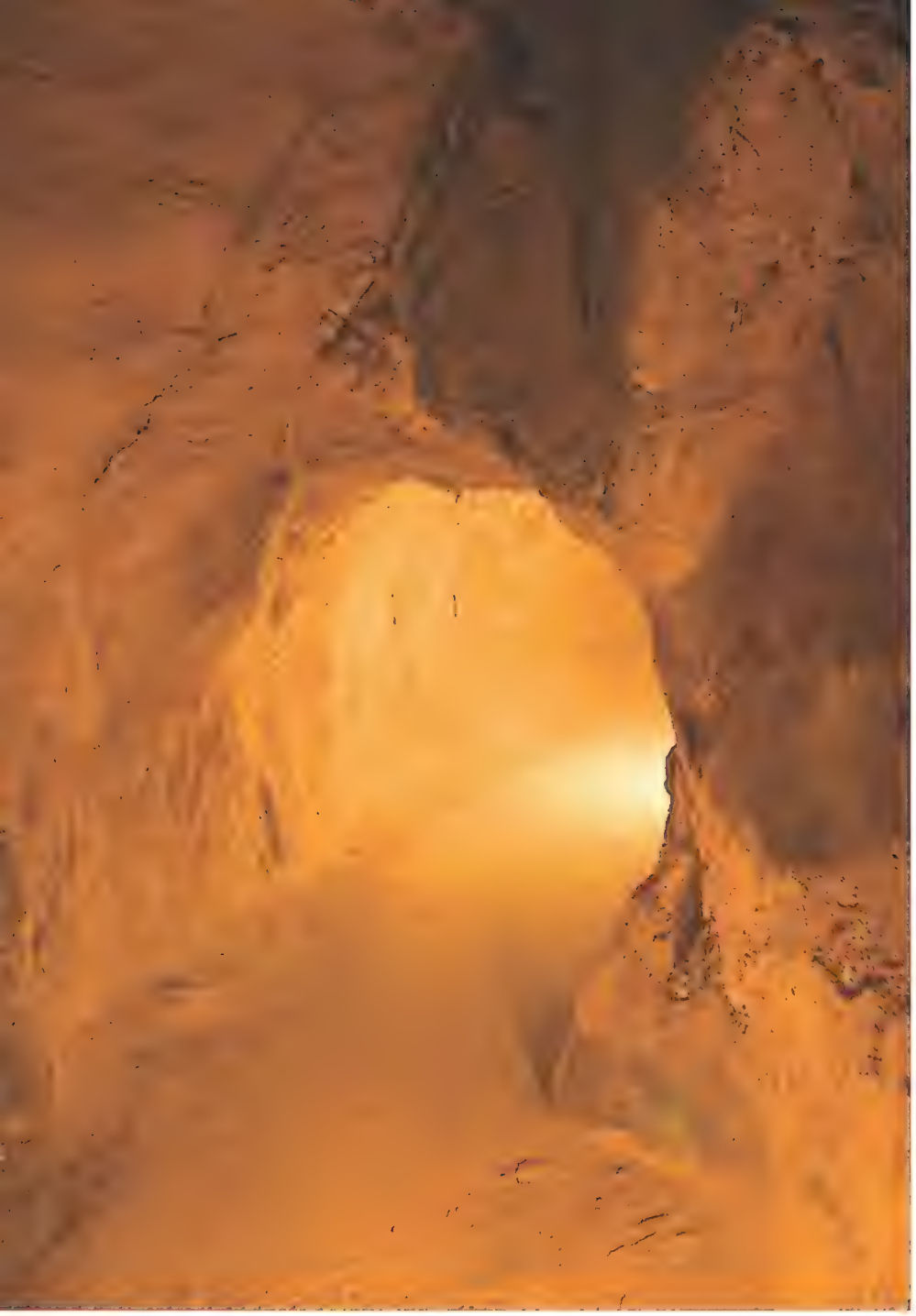
In April 2007, his team discovered hundreds of red limestone fragments buried in the mountainside. Many bore delicate rosettes—a motif common to Jewish ossuaries and some sarcophagi of the era. Reassembling some of the pieces, Netzer concluded they were all that remained of a sarcophagus more than eight feet long with a gabled cover. The high quality of the craftsmanship suggested the sarcophagus was fit for a king. Plus, the extent of the fragmentation suggested that people had deliberately smashed it—a plausible outcome for the hated monarch's resting place. Based on coins and other items found nearby, Netzer surmises that the desecration occurred during the first Jewish revolt against the Romans, from A.D. 66 to 73. (As Kasher notes in his biography, "Herod the Great" was, for the Jews, an ironic title, designating an arrogant monarch who scorned the religious laws of his own people.)

Within two weeks of finding the rosette fragments, workers unearthed the remains of two white limestone sarcophagi strewn about the tomb. Netzer believes one could have

The fragmentation suggests that the sarcophagus was deliberately smashed—a plausible outcome for the hated monarch's resting place.

held Herod's fourth wife, Malthace, mother of his son Archelaus. The third sarcophagus might be that of Archelaus' second wife, who, based on the accounts of Josephus, was likely named Glaphyra. Workers also found a few bone fragments at the tomb site, though Netzer is skeptical that an analysis of the scant remains will yield any meaningful information about the identities of those buried at Herodium.

Netzer acknowledges that absent further evidence, the rosette-decorated sarcophagus cannot be definitively assigned to Herod. Duane Roller, professor emeritus of Greek and Latin at Ohio State University and author of the 1998 book *The Building Program of Herod the Great*, concedes that the tomb belonged to someone of noble lineage, but is convinced that Herod's burial site is at the base of the summit tower. For one thing, Roller notes its similarity to other tombs built in Italy at that time. The lack of an inscription particularly troubles some scholars. David Jacobson, a researcher affiliated with University College London and the Palestine Exploration Fund, suggests that a sarcophagus of a very important personage would have been inscribed, and he points to that of



Queen Helena of Adiabene, which was recovered from her royal mausoleum in Jerusalem. But others, including Netzer, point out that it was not common for Jews of that era to inscribe sarcophagi. Besides, it's plausible that Herodium itself was the inscription; the entire edifice declares, "Behold me!"

CLAD IN WORK SHORTS, hiking shoes and a well-worn leather Australian bush hat, Netzer scampers up the path to the tomb site. The septuagenarian offers me a hand as I seek a toehold. He greets the crew in Hebrew and Arabic as we pass from one section, where workers wield pickaxes, to another, where a young architect sketches decorative elements.

The tomb site is nearly barren, but the podium that bore the royal sarcophagus hints at magnificence. It is set into the stony earth, partially exposed and unmarred, the joints between the smooth white ashlars (slabs of square stone) so fine as to suggest they were cut by a machine. Netzer has also found the corner pilasters (columns partially built into the walls), enabling him to estimate that the mausoleum, nestled against the side of the mountain, stood on a base 30 by 30 feet and was some 80 feet high—as tall as a seven-story building. It was built

Herodium was "a place of enjoyment and pleasure." Clockwise, from top left: The domed ceiling of a royal bathhouse; a tunnel within the mountain; a theater that accommodated some 450 spectators. Herod and his honored guests sat in a royal box, decorated with vivid landscape paintings and facades (right).

of a whitish limestone called *meleke* (Arabic for "royal") that was also used in Jerusalem and in the nearby Tomb of Absalom—named after the rebellious son of King David, but likely the tomb of the Judean King Alexander Jannaeus.

The mausoleum's design is similar to the Tomb of Absalom, which dates to the first century B.C. and is notable for its conical roof, a motif also seen at Petra. The remnants of the mausoleum's facade are composed of the three elements of classical entablature: architraves (ornamental beams that sit atop columns), friezes (horizontal bands above the architraves) and cornices (crown molding found on the top of buildings). Netzer has also found pieces of five decorative urns. The urn was a funerary motif, used notably at Petra.

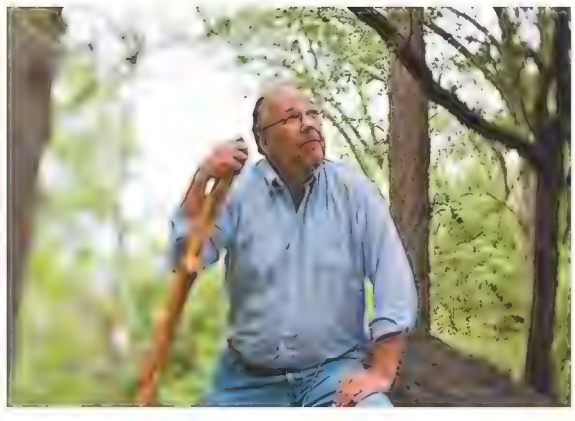
Despite the work still to be done—excavating, assembling, publishing the data—Netzer is clearly gratified by what he has learned, which is, he says, the "secret" of Herodium: how Herod found a way to keep his vow and be buried in the desert. "In my field, ancient archaeology, you could say that once circumstances give me the opportunity to be quite certain, it's not in my character to have further doubts."

RELI SARAF; DUBY TAL / ISRAELIMAGES; GABI LARON / HEBREW UNIVERSITY INSTITUTE OF ARCHAEOLOGY (2)

Mad *About* Shells

For centuries, scientists, collectors and thieves risked life, limb and fortune to gather the rarest specimens. Now interest is turning to the medical potential of the animals within

BY RICHARD CONNIFF SHELL PHOTOGRAPHY BY SEAN MCCORMICK



Phil Quinton had disabling leg pain until a doctor told him about a drug derived from the venom of a marine snail (opposite).

WHEN PHIL QUINTON GOT ROLLED UNDER A LOG AT A California sawmill some years ago, he crawled out and went back to work. It turned out that he had a crushed spine. After an operation the pain just got worse, Quinton says, and he learned to self-medicate with drugs and alcohol. Eventually, his doctors put him on massive doses of morphine until he could no longer stand the side effects.

Then a doctor told him about cone snails—a group of marine snails, beautiful but deadly—and a new drug, a synthetic derivative from the venom of one of them, *Conus magus*, the magician's cone. Quinton had actually seen cone snails kill fish in an aquarium and on television, and it *was* a kind of magic, given that snails move at a snail's pace and generally cannot swim. "It took 20 minutes," he says, "but the snail came over to the fish and put out this long skinny thing and touched it, and that fish just froze."

The snail's proboscis was a hypodermic needle for its venom, a complex cocktail of up to 200 peptides. Quinton

NICOLE MORGENTHAU / AURORA SELECT

The magician's cone snail, or *Conus magus*, is fatal to fish (and, occasionally, humans). A boy who collected *C. magus* shells in the Philippines later pioneered research that led to a new class of medicines based on the snail's chemically sophisticated venom.

also knew that cone snails have at times killed people. But for the drug, called Prialt, researchers synthesized a single venom peptide that functions as a calcium-channel blocker, bottling up pain by interfering with signals between nerve cells in the spinal cord. The third day after he started taking Prialt, says Quinton, now 60, the pain in his legs went away. It wasn't a miracle cure; he still had back pain. But for the first time in years, he could go out for a daily walk. He owed his recovery to one of the most underrated pastimes in human history: shell collecting.

THE PECULIAR HUMAN PASSION for the exoskeletons of mollusks has been around since early humans first started picking up pretty objects. Shellfish were, of course, already familiar as food: some scientists argue that clams, mussels, snails and the like were critical to the brain development that made us human in the first place. But people also soon noticed their delicately sculpted and decorated shells. Anthropologists have identified beads made from shells in North Africa and Israel at least 100,000 years ago as among the earliest known evidence of modern human culture.

Since then various societies have used shells not just as ornaments, but also as blades and scrapers, oil lamps, currency, cooking utensils, boat bailers, musical instruments and buttons, among other things. Marine snails were the source of the precious purple dye, painstakingly collected one drop at a time, that became the symbolic color of royalty. Shells may also have served as models for the volute on the capital of the Ionic column in classical Greece and for Leonardo da Vinci's design for a spiral staircase in a French chateau. In fact, shells inspired an entire French art movement: Rococo, a word blending the French *rocaille*, referring to the practice of covering walls with shells and rocks, and the Italian *barocco*, or Baroque. Its architects and designers favored shell-like curves and other intricate motifs.

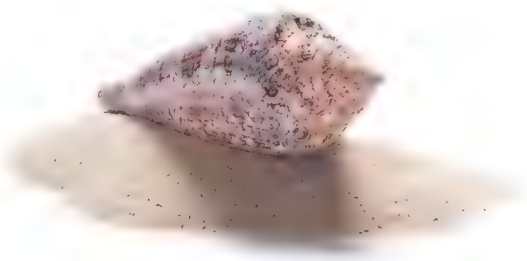
The craving for shells was even powerful enough to

change the fate of a continent: at the start of the 19th century, when rival French and British expeditions set out for the unknown coasts of Australia, the British moved faster. The French were delayed, one of those on board complained, because their captain was more eager "to discover a new mollusk than a new landmass." And when the two expeditions met up in 1802 at what is now Encounter Bay, on the south coast of Australia, a French officer complained to the British captain that "if we had not been kept so long picking up shells and catching butterflies . . . you would not have discovered the south coast before us." The French went home with their specimens, while the British quickly moved to expand their colony on the island continent.

THE MADNESS FOR SHELLS that took hold of European collectors from the 17th century onward was largely a byproduct of colonial trade and exploration. Along with spices and other merchandise, ships of the Dutch East India Company brought back spectacularly beautiful shells from what is now Indonesia, and they became prized

"Conchylomania" soon rivaled the Dutch madness for collecting tulip bulbs, and often afflicted the same people.

items in the private museums of the rich and royal. "Conchylomania," from the Latin *concha*, for cockle or mussel, soon rivaled the Dutch madness for collecting tulip bulbs, and often afflicted the same people. One Amsterdam collector, who died in 1644, had enough tulips to fill a 38-page inventory, according to *Tulipmania*, a recent history by Anne Goldgar. But he also had 2,389 shells, and considered them so precious that, a few days before his death, he had them put away in a chest with three separate locks. The three executors of his estate each got a single key, so they could show the collection to potential buyers only when all three of them were present. Dutch writer Roemer Visscher mocked both tulip maniacs and "shell-lunatics." Shells on the beach that used to be playthings for children now had the price of jewels, he said. "It is bizarre what a madman spends his money on."



At an 18th-century auction in Amsterdam, Vermeer's *Woman in Blue Reading a Letter* (top) sold for about one-third the amount that its owner spent to obtain a then rare *Conus gloriamaris* shell (above).

And he was right: at one 18th-century auction in Amsterdam, some shells sold for more than paintings by Jan Steen and Frans Hals, and only slightly less than Vermeer's now-priceless *Woman in Blue Reading a Letter*. The collection also included a *Conus gloriamaris* shell, for which the owner had paid about three times what his estate was getting for the Vermeer.

From a financial perspective, valuing shells over Dutch masters may rank among the dumbest purchases ever. There are only 30-some known Vermeer paintings on earth. But the scarcity that could make a shell seem so precious was almost always illusory. For instance, *C. gloriamaris*, a four-inch-long cone covered in a delicate fretwork of gold and black lines, was for centuries among the most coveted species in the world, known from only a few dozen specimens. One shell-trade story held that a wealthy collector who already owned a specimen managed to buy another at auction and, in the interest of scarcity, promptly crushed it underfoot. To maintain prices, collectors also spread the rumor that an earthquake had destroyed the species' habitat in the Philippines and rendered it extinct. Then in 1970, divers discovered the mother lode in the Pacific, north of Guadalcanal Island, and the value of *C. gloriamaris* plummeted. Today you can buy one for roughly the price of dinner for two at a nice restaurant. And paintings by Vermeer? The last time one came on the market, in 2004, it went for $30 million. (And it was a minor and slightly questionable one at that.)

But what seems common to us could seem breathtakingly rare to early collectors, and vice versa. Daniel Margocsy, a historian of science at Northwestern University, points out that Dutch artists produced five million or more paintings in the 17th century. Even Vermeers and Rembrandts could get lost in the glut, or lose value as fashions shifted. Beautiful shells from outside Europe, on the other hand, had to be collected or acquired by trade in distant countries, often at considerable risk, then transported long distances home on crowded ships, which had an alarming tendency to sink or go up in flames en route.

The shells that got through to Europe in the early years were mostly sold privately by sailors and civil administrators in the colonial trade. When Capt. James Cook returned from his second round-the-world voyage in 1775, for instance, a gun-

TOP: RIJKSMUSEUM, AMSTERDAM / BRIDGEMAN ART LIBRARY INTERNATIONAL

An 18th-century French connoisseur voiced a common sentiment when he wrote that shells revealed "the excellent artisan of the Universe." Only God, one collector concluded, could have created the ribbed spiral of the precious wentletrap (above and left).

ner's mate aboard the *Resolution* wrote offering shells to Sir Joseph Banks, who had served as naturalist for Cook's first circumnavigation a few years earlier.

"Begging pardon for my Boldness," the note began, in a tone of forelock-tugging class deference. "I take this opportunity for acquainting your Honour of our arrival. After a long and tedious Voyage . . . from many strange Isles I have procured your Honour a few curiosities as good as could be expected from a person of my capacity. Together with a small assortment of shells. Such as was esteem'd by pretended Judges of Shells." (The last line was a sly jibe at the lesser naturalists who had taken Banks' place on the second circumnavigation.) Dealers sometimes waited at the docks to vie for new shells from returning ships.

For many collectors of that era, shells were not just rare, but literally a gift from God. Such natural wonders "declare the skilful hand from which they come" and reveal "the excellent artisan of the Universe," wrote one 18th-century French connoisseur. The precious wentletrap, a pale white spiral enclosed by slender vertical ribs, proved to another collector that only God could have created such a "work of art."

Such declarations of faith enabled the wealthy to present their lavish collections as a way of glorifying God rather than themselves, writes British historian Emma Spary. The idea of gathering shells on the beach also conferred spiritual status (although few wealthy collectors actually did so themselves). It symbolized escape from the workaday world to recover a sense of spiritual repose, a tradition invoked by luminaries from Cicero to Newton.

In addition, many shells suggested the metaphor of climbing a spiral staircase and, with each step, coming closer to inner knowledge and to God. The departure of the animal from its shell also came to represent the passage of the human soul into eternal life. The nautilus, for instance, grows in a spiral, chamber upon chamber, each larger than the one before. Oliver Wendell Holmes made it the basis for one of the most popular poems of the 19th century, "The Chambered Nautilus": *Build thee more stately mansions, O my soul, / As the swift seasons roll! / . . . Till thou at length art free, / Leaving thine outgrown shell by life's unresting sea!*

Oddly, collectors didn't much care about the animals that actually built the shells. Holmes, for instance, unwittingly blended the characteristics of two separate nautilus

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RICHARD CONNIFF'S *new book,* Swimming With Piranhas at Feeding Time, *includes many stories he's written for the magazine.* **SEAN MCCORMICK** *is a Washington, D.C.-based photographer.*

species in his poem, according to shell historian Tucker Abbott: "It was as if he had written a poem about a graceful antelope who had the back half of a leopard and the habit of flying over the arctic ice." Collectors often cared passionately about new species, but mainly for the status of possessing something strange and unusual from a distant land, preferably before anybody else.

The absence of flesh-and-blood animals actually made shells more appealing, for a highly practical reason. Early collectors of birds, fish and other wildlife had to take elaborate and sometimes gruesome measures to preserve their precious specimens. (A typical set of instructions to bird collectors included the admonition to "open the Bill, take out the Tongue and with a sharp Instrument pierce through the roof of the Mouth to the Brain.") But those specimens inevitably succumbed to insects and decay anyway, or the beautiful colors faded to mere memory.

Shells endured, more like jewels than living things. In the 1840s, a British magazine recommended that shell collecting was "peculiarly suited to ladies" because "there is no cruelty in the pursuit" and the shells are "so brightly clean, so ornamental to a boudoir." Or at least it seemed that way, because dealers and field collectors often went to great lengths to remove any trace of a shell's former inhabitant.

Jerry Harasewych (top: at the National Museum of Natural History) notes that among other curious snail behaviors, the Cooper's nutmeg snail (above) can burrow beneath resting angel sharks to suck their blood.

IN FACT, HOWEVER, the animals that build shells have turned out to be far more interesting than collectors ever supposed. One day at the Smithsonian's National Museum of Natural History, which owns the world's largest shell collection, research zoologist Jerry Harasewych was cutting open a small land snail shell from the Bahamas. For scientific purposes, the museum preserves shells in as close to their natural state as possible. These specimens had been stored in the collection four years earlier. But Harasewych suddenly noticed something moving inside. It reminded him of an apocryphal story about a museum where the air conditioning quit and snails, resurrected by the humidity, came oozing out of the collection drawers. He put some of the other dried snails in water, he said, and they too started moving. It turned out that these snails live on dunes in sparse vegetation. "When it starts to get hot and dry, they seal themselves up within their shells," he said. "Then when the spring rains come, they revive."

Among other surprising behaviors, said Harasewych, a muricid snail can climb aboard an oyster, drill through its shell, then insert its proboscis and use the teeth at the tip to rasp up the oyster's flesh. Another species dines on shark: the Cooper's nutmeg snail works its way up through the sand underneath angel sharks resting on the bottom in the waters off California. Then it threads its proboscis into a vein in the gills and sucks the shark's blood. For the shark, it's like a gooey mosquito bite.

The eat-or-be-eaten dynamic is one of the reasons shells evolved in the first place, more than 500 million years ago. Calcium, the basic building material, is a major component of seawater, and turning it into housing had obvious protective advantages. Largely for purposes of self-defense, shellfish quickly moved beyond mere shelter to develop a dazzling array of knobs, ribs, spines, teeth, corrugations and thickened edges, all of which serve to make breaking and entering more difficult for predators. This shell-building boom became so widespread, according to a 2003 paper in *Science*, that the exploitation of calcium carbonate by shellfish may have altered the earth's atmosphere, helping to create the relatively mild conditions in which humans eventually evolved.

Some shellfish also developed chemical defenses. Harasewych opened a museum locker and pulled out a drawerful of slit shells, gorgeous conical whorls of pink and white. "When they're attacked, they secrete large quantities of white mucus," he said. "We're doing work on the chemistry right now. Crabs appear to be repelled by it." Slit shells can repair predator damage, he said, indicating a five-inch-long scar where one shell had patched itself after being attacked by a crab. (Humans also attack, but not so often. A photograph on the cabinet door showed

The specimens had been stored four years earlier. But the zoologist suddenly noticed something moving inside.

SEAN MCCORMICK; LOVELL & LIBBY LANGSTROTH / CALPHOTOS

Drawing on the calcium in seawater, marine creatures began to create shells more than 500 million years ago. They quickly developed a variety of knobs, spines, ribs, teeth and corrugations for additional protection (above and left: a spiny oyster shell).

Harasewych in the kitchen with Yoshihiro Goto, the Japanese industrialist who donated much of the museum's slit shell collection. The two celebrated the gift, Harasewych noted, by preparing a slit shell dinner with special knives and sauces. Don't try this at home. "I've eaten well over 400 species of mollusk, and there are maybe a few dozen I'd eat again," said Harasewych. This one was "pretty foul.")

Some shellfish have even evolved to attract and exploit would-be predators. The United States happens to lead the world in biodiversity of freshwater mussels, a generally dull-looking, bad-tasting bunch—but with an astonishing knack for using fish as their incubators. One mussel species trolls a gluey lure in the water as much as a meter away from the mother shell. When a hungry fish snaps up this Trojan horse—it's actually a string of larvae—the larvae break loose and attach themselves to the fish's gills. For the next few weeks, part of the fish's energy goes to feeding these hitchhikers. In another mussel, the edge of the fleshy mantle looks and even twitches like a minnow. But when a fish tries to grab it, the mussel blasts the fish's gaping mouth with larvae. Yet another species, the snuffbox mussel from Pennsylvania's Allegheny River, actually has inward-curving teeth on the shell edge to hold a fish in a headlock while it covers its gills with larvae. Then it lets the bamboozled fish stagger off to brood baby snuffboxes.

A pretty shell, like a pretty face, clearly isn't everything.

COLLECTORS THESE DAYS tend to be interested in both beauty and behavior, which they sometimes discover firsthand. At the Academy of Natural Sciences in Philadelphia not long ago, collectors at a shell show swapped stories about the perils of fieldwork. A retired doctor had been bitten by a soft-shelled turtle while feeling for freshwater mussels. A diver had suffered an excruciating sting from a bristle worm. A retired pilot said he had had his middle finger ripped down both sides by a moray eel off the coast of Gabon, but added, "It's kind of worth it for a new species."

"New to science?" someone asked.

"The heck with science," he replied. "New to me."

Then the conversation turned to methods for separating mollusks from their shells. One low-tech approach is to leave the shells out for fire ants to clean, but high-tech works too. "Microwave cleaning is the greatest," one collector volunteered. Pressure builds up in the shell, he said, till it "blows the meat right out the aperture"—*Phwap!*—"like a cap gun."

So much for spiritual repose.

Downstairs at the museum, dealers had laid out a roomful

"I was totally dumbfounded," he recalled. The shell was from a snail that until then had been considered extinct.

of tables with thousands of microwaved, bleached, oiled and polished specimens. They included some of the most spectacular of the roughly 100,000 mollusk species now known, and they were liable to have come from almost anywhere on earth. A dealer named Richard Goldberg pointed out that animals with shells have been found living in the Marianas Trench, 36,000 feet deep, and in a Himalayan lake 15,000 feet above sea level. Though people tend to think of them as "sea shells," some species can survive even under a cactus in the desert. Goldberg added that he became interested in land snails after years as a seashell collector when a friend dared him to find shells in a New York City backyard. Goldberg turned over a few rocks and came up not just with three tiny land snails, but with three distinct species.

As boys, biochemist Baldomero Olivera (top left) and dealer Donald Dan (top right) shared a shell hobby. Of the six known specimens of the *Sphaerocypraea incomparabilis* (above), Dan has examined four.

Another dealer, Donald Dan, bustled back and forth among his displays. Like a jeweler, he wore flip-up lenses on his gold-rimmed eyeglasses. At 71, Dan has silver hair brushed back in a wave above his forehead and is one of the last of the old-time shell dealers. Though more and more trading now takes place via the Internet, Dan does not even maintain a Web site, preferring to work through personal contacts with collectors and scientists around the world.

Dan said he first got interested in shells as a boy in the Philippines, largely because a friend's father played tennis. The friend, Baldomero Olivera, used to meet his father every day after school at a Manila tennis club. While he waited for his ride home, Olivera got in the habit of picking through the pile of shells dredged up from Manila Bay to be crushed and spread on the tennis courts. Thus Olivera became a collector and recruited his classmates, including Dan, to join him in a local shell club. Because cone snails were native to the Philippines and had an interesting reputation for killing people, Olivera went on to make their venom his specialty when he became a biochemist. He's now a professor at the University of Utah, where he pioneered the research behind a new class of cone-snail-derived drugs—including the one that relieved Phil Quinton's leg pain.

Dan became a collector, too, and then a dealer, after a career as a corporate strategist. Sometime around 1990, a rumor reached him through the collecting grapevine about a beauti-

Get a behind-the-scenes look at the Smithsonian's shell collection at Smithsonian.com/shells

TOP LEFT: NICOLE MORGENTHAU / AURORA SELECT; TOP RIGHT: BOB CROSLIN

Shells of the snail *Cypraea fultoni* (above and left) had been found only in the bellies of bottom-feeding fish until 1987, when a Russian trawler raked up a bunch of specimens off South Africa. Prices fell from a high of $15,000 to mere hundreds today.

ful item of obscure identity being hoarded by Russian collectors. Dan, who now lives in Florida, made discreet inquiries, loaded up on trade items and, when visa restrictions began to relax, flew to Moscow. After protracted haggling, Dan obtained the prized shell, a glossy brown oval with a wide mouth and a row of fine teeth along one edge. "I was totally dumbfounded," he recalled. "You couldn't even imagine that this thing exists." It was from a snail that until then had been thought to have gone extinct 20 million years ago. Among shell collectors, Dan said, it was like finding the coelacanth, the so-called fossil fish.

Dan later purchased another specimen of the same species, originally found by a Soviet trawler in the Gulf of Aden in 1963. By looking inside through a break that had occurred when the shell rolled out of the net onto the deck of the ship, scientists were able to identify it as a member of a family of marine snails called Eocypraeidae. It's now known as *Sphaerocypraea incomparabilis*.

One of the few other known specimens belonged to a prominent Soviet oceanographer—"a very staunch Communist," Dan said—who at first refused to sell. Then the value of the ruble deteriorated in the 1990s. To earn hard currency, the Russians were providing submersibles for the exploration of the wreck of the *Titanic*. The staunch Communist oceanographer found himself in need of hard currency, too. So one of the operators on the *Titanic* job brought the shell with him on a trip to North America, and Dan made the purchase.

He sold that shell and his first specimen to a private collector, and in time that collection was given to the American Museum of Natural History in New York City, which hired Florida shell dealer Martin Gill to appraise its value. Dan's love affair with *S. incomparabilis* marked the high point of his life as a dealer: there are still only six known specimens in the world, and he had handled four of them.

A few years later, an American Museum of Natural History curator who was showing *S. incomparabilis* to a reporter discovered that one of the two shells was missing. The world of top shell collectors is relatively small, and an investigation soon suggested that, for Martin Gill, the temptation to pocket such a jewel-like prize had simply been too great. Gill had advertised a suspiciously familiar shell for sale and then sold it over the Internet to a Belgian dealer for $12,000. The Belgian in turn had sold it to an Indonesian collector for $20,000. An investigator for the museum consulted Dan. By comparing his photographs with one from the Indonesian collector, Dan spotted a telltale trait: the truncated 13th tooth in both specimens was identical. The shell came back to the museum, the Belgian dealer refunded the $20,000 and Gill went to prison.

It was proof that conchylomania lives.

Katz (today, in SoHo) pursued figurative painting even in the 1950s, when Abstract Expressionism was at its height. The artist, says Adam Weinberg of the Whitney Museum, "is a man of supreme confidence."

COOL KATZ

Octogenarian artist Alex Katz has never been more productive—nor more in demand

BY CATHLEEN MCGUIGAN

PHOTOGRAPHS BY STEPHANIE SINCLAIR

THE CAVERNOUS LOBBY of New York City's Metropolitan Museum of Art is jammed with people, but it is impossible to miss Alex Katz. The artist famous for his bright figurative paintings is standing by the information desk wearing a parka so blindingly orange it looks radioactive. Orange is one of Katz's favorite colors, and the jacket, adorned with reflective silver strips, is the kind that a guy on a road crew might wear to direct traffic in a rainstorm. But this French-made parka is downright chic, rather like its owner, who looks at least a decade younger than his 82 years, with a smooth head (he shaves it daily) and features as sharp as those of the suave figures who populate his paintings.

He has come to the Met to see an exhibition of works by Pierre Bonnard, the French Post-Impressionist who was a big influence when Katz was starting out. "Bonnard was very important in the early 1950s," Katz says. "His painting was in the same direction as [Jackson] Pollock—away from a contained plane. It was all over light, just light and color." He goes on: "They're great paintings; they have great atmosphere. Bonnard's great with reds and oranges—it is very hard to get transparency with red!"

A maverick from the beginning, Katz came of age when Abstract Expressionism still reigned, yet he turned to painting landscapes and the human figure. Over time, his paintings got bigger. "Appropriating the monumental scale, stark composition and dramatic light of the Abstract Expressionists, he would beat the heroic generation at their own game," the critic Carter Ratcliff wrote in a 2005 monograph on Katz.

"It was an open door," Katz says today. "No one was doing representational painting on a large scale."

Taking cues from Cinemascope movies and billboards, his highly stylized pictures

also anticipated Pop Art. His deadpan evocation of flat, bright figures had an everyday quality that linked them to commercial art and popular culture. Early on, his work was often panned. Clement Greenberg, the critic famous for championing the Abstract Expressionists, "actually went out of his way to say how lousy I was," Katz recalled in an article he wrote for the *New Criterion*.

But critical opinion has never seemed to matter to Katz. "Alex is a man of supreme confidence and clarity," says Adam Weinberg, director of the Whitney Museum of American Art. "He quickly realized what he was about and was absolutely undaunted and single-minded in that pursuit. That persistence enabled him to weather the contradictory movements in the art world."

Today, Katz's popularity is exploding. His quintessentially American evocations of people at cocktail parties or the beach and his landscapes of Maine took off in Europe, especially after the collector Charles Saatchi showed off his Katzes in his private museum in London a decade ago. The painter has also found a substantial new audience at home in the United States. As figurative painting made a comeback in the late '80s and '90s, a younger generation of artists began to see Katz with new appreciation. "Artists were looking at their predecessors, but there were not a lot of them who'd continued in that figurative zone consistently, with his level of detachment," says Weinberg. "Coolness is something that artists of all generations admire—cool in the sense of detachment, but [also] cool in the sense of hip."

Like Warhol before him, Katz has no problem bridging the worlds of art and fashion, whether creating artwork for *W* magazine or getting supermodels such as Christy Turlington and Kate Moss to sit for him. "I've always been interested in fashion because it's ephemeral," he says. Katz himself even modeled for the J. Crew spring catalog this year.

The stylish octogenarian is, by his own account, as busy as ever. So far this year, Katz has had exhibitions in Milan and Catanzaro in Italy, Paris, Vero Beach in Florida, Finland and at his New York City gallery, PaceWildenstein, where he recently showed a series of monumental sunsets.

"I WANT TO COMPETE WITH THE KIDS!" he said one afternoon while sitting on a leather sofa in his sparsely furnished SoHo loft, in Manhattan, where he has lived since 1968. Just beyond the living room is his studio, an airy, white-walled space that floods with daylight. There isn't a speckle of paint on the linoleum floor. "I don't like mess," says Katz. "I don't like paint on my clothes or my hands or my furniture."

A series of gigantic, freshly painted canvases are propped up around the studio—each a frieze of enormous heads, some of men, others women. The pieces are reminiscent of what the artist was doing decades ago, most memorably in a series of Times Square murals he made in 1977. "I've been working to make this kind of 'artificial realistic' painting," he says of the latest efforts. "I want to do something larger than a descriptive painting."

To make one of his large works, Katz paints a small oil sketch of a subject on a masonite board; the sitting might take an hour and a half. He then makes a small, detailed drawing in pencil or charcoal, with the subject returning, perhaps, for the artist to make corrections. Katz next blows up the drawing into a "cartoon," sometimes using an overhead projector, and transfers it to an enormous canvas via "pouncing"—a technique used by Renaissance artists, in-

ALEX KATZ / PACE WILDENSTEIN GALLERY, LICENSED BY VAGA, NEW YORK; BRANDHORST COLLECTION, LICENSED BY VAGA, NEW YORK; PP. 52-53 STEPHANIE SINCLAIR / VII

Deft handling of flat color and an impulse to document reality define Katz's paintings (from left: *Poppies*, 1967; *The Black Dress*, 1960; *Kenneth*

volving powdered pigment pushed through tiny perforations pricked into the cartoon to recreate the composition on the surface to be painted. Katz pre-mixes all his colors and gets his brushes ready. Then he dives in and paints the canvas—12 feet wide by 7 feet high or even larger—in an epic session of six or seven hours. "It's all done wet on wet," he explains. The paints blend and become luminous.

From far away or in reproduction, Katz's pictures look hyper-smooth, but up close you notice the brushstrokes and the small bits of accent color that attract the eye. More than painterly technique or the image depicted, though, his work is about the style. "I'd just as soon have the style be the content, style rather than form," he says. "The style is what puts all the disparate parts together."

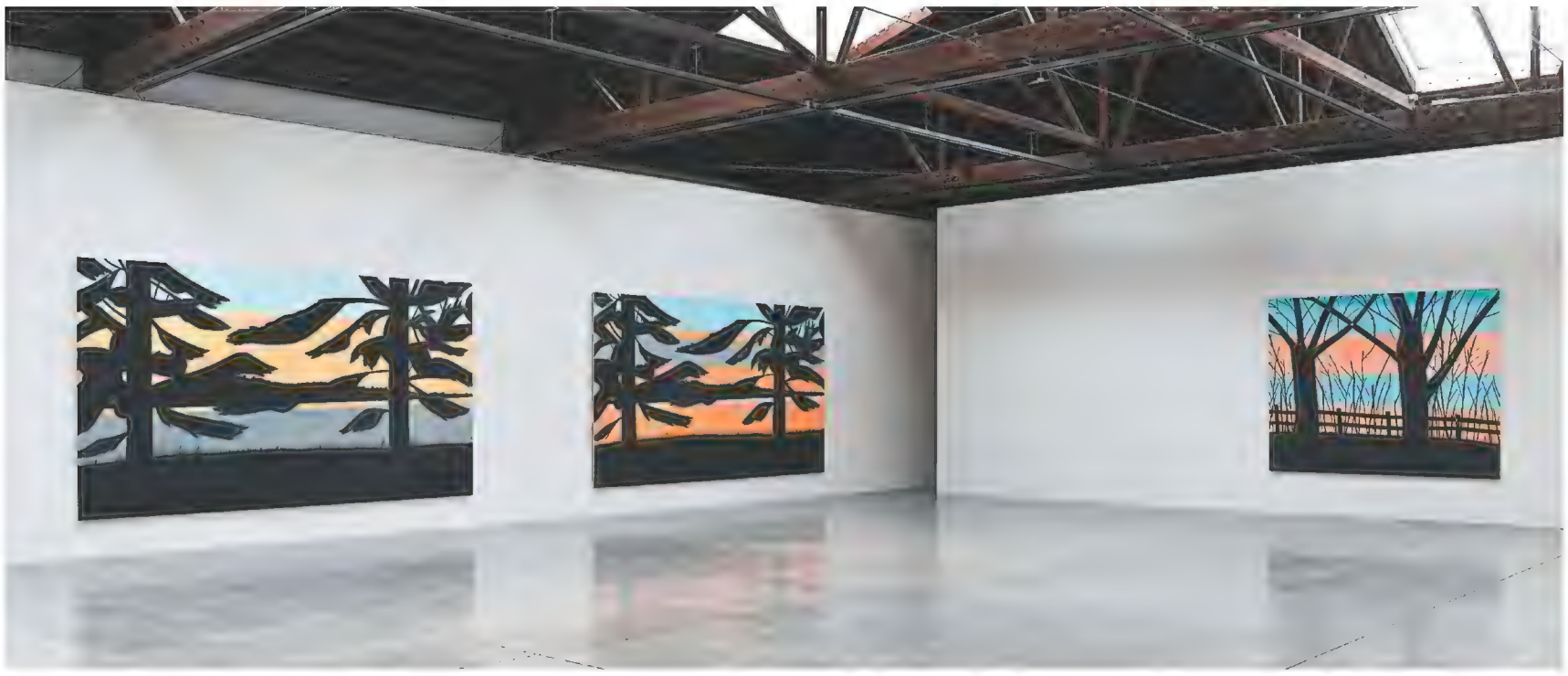
Katz's wife, Ada, and son, Vincent, are frequent subjects (clockwise from top left: the artist and Ada, 1958; Vincent, 1982; Ada and Alex, 2007; portrait of the couple, 1980). In Ada, he found "a great beauty" and his muse.

Katz's wife, Ada, walks into his studio, offering coffee. A visitor might be forgiven for presuming to have met her before, so familiar is she as Katz's muse and model over the course of their 51-year marriage. The long hair that brushes her shoulders is gray now, but the expressive dark eyes in her serene face are the same as those that look out from under a hat in *Red Coat* (1982), from under an umbrella in *The Blue Umbrella* (1972) and from all six Adas wearing the same glamorous cocktail sheath in one of his most popular works, *The Black Dress* (1960). Her husband says she's an American version of Picasso's famous model and mistress Dora Maar. But, Katz is quick to add, "When I saw photos of Dora Maar, I said, 'Picasso cheated on her neck and shoulders!' Ada has a much better neck and shoulders."

Katz's speech still bears traces of his childhood in Queens, New York. The son of an émigré who'd lost a factory he owned in Russia to the Soviet revolution, Katz "drifted into fine art," he says. He was studying commercial art at a local vocational high school when he began to draw from casts of antique sculpture and won admission to the Cooper Union School of Art in Manhattan. He met Ada, who had studied biology at New York University, at a gallery opening in 1957. "She's a great beauty," he says. "The gestures are perfect. She's like an actress in a sense. She's also a very sharp Italian girl from the Bronx—you can't beat that." (The couple have one son, Vincent Katz, 49, a poet and art critic.) Social life with Ada in the

***Koch*, 1967; *Red Smile*, 1963). Ultimately, the artist told curator and critic Robert Storr, "I'm painting the society in which I live."**

ALEX KATZ / PACEWILDENSTEIN GALLERY, LICENSED BY VAGA, NEW YORK; JOAN AND ALAN SAFIR COLLECTION, LICENSED BY VAGA, NEW YORK; BILL LYONS / ADMEDIA; ALEX KATZ / PACEWILDENSTEIN GALLERY, LICENSED BY VAGA, NEW YORK; WHITNEY MUSEUM OF AMERICAN ART, NEW YORK, LICENSED BY VAGA, NEW YORK



The artist's recent *Sunset* series imparts permanence to an ephemeral moment. The paintings, he says, "will stay with you."

'50s and '60s revolved around poets—Frank O'Hara, John Ashbery, Kenneth Koch—as much as painters. "They were dealing with everyday experiences, in a kind of sophisticated way," Katz recalls. (In Katz's 1967 portrait, Koch looks slightly uneasy behind a big pair of horn-rimmed glasses.)

Katz may be best known for his portraits, but he has also devoted himself to landscapes—works that are daring precisely because they lack people and "throw away the lifelines" of human interest, noted the critic David Cohen. "They work on Katz's own painterly terms or not at all." Many are evocations of Maine, where he has gone to paint every summer for the past 60 years, and where he has a house and studio on a small lake.

"It's a conceit in a way," Katz says. "It's like you can paint the same river twice differently. I often paint in the same place. It's like painting Ada over and over again—to see if you can get something else out of the same subject matter."

The Colby College Museum of Art, in Waterville, Maine, has devoted a 10,000-square-foot wing to Katz's artworks, the majority of which he donated. In addition, he has purchased numerous pieces for the museum by artists such as Jennifer Bartlett, Chuck Close, Francesco Clemente, Elizabeth Murray and, most recently, Marsden Hartley (a Maine native). Five years ago, he curated a show

G.R. CHRISTMAS / PACEWILDENSTEIN GALLERY; PHOTO: JOERG LOHSE / PACEWILDENSTEIN GALLERY. © ALEX KATZ / LICENSED BY VAGA, NEW YORK; ALEX KATZ / PACEWILDENSTEIN GALLERY, LICENSED BY VAGA, NEW YORK (2)

The capturing of changing landscapes and everyday experience preoccupy Katz (from left: *Twilight*, 2007; *Spruce*, 1994; *Daytona Beach 3*, 1994;

at Colby of such young art stars as Elizabeth Peyton, Peter Doig and Merlin James, who work in the same figurative territory staked out by Katz.

KATZ'S AGELESSNESS is hard won. He's a super-jock, who runs and does "tons of" push-ups and sit-ups when he's home in New York; in Maine, he works out, he says, up to four hours a day—running, bicycling and swimming. How far can he run? "As far as I like. I can outperform a lot of 21-year-olds physically," he says.

He says he also competes with artists half his age "for the audience," though with limited weaponry. "My subject matter is not particularly interesting," he says with a smile. "It's not hot subject matter—you know, no crucifixions, no violence, no sex." His tools are color and light, and his own stripped-down vision of the world. "I try to make painting that looks simple," he says, and cites seeing a Velázquez portrait of a Hapsburg infanta in a traveling exhibition at the Metropolitan Museum when he was in his mid-20s: "It was nothing—so simple! Something could be so simple and so much. Just a green background, a little girl—everything was perfect. There's no story line. It's immediate. He painted directly. He saw it, he painted it."

A Katz painting, for all its coolness, projects feeling. "The pictures are supposed to be lyric, they're supposed to give you an up," he says. "I want to make something that's sort of like your happier condition. Impressionist pictures are basically that—Impressionist painting is a happy lie."

Katz's happy lies are those timeless beautiful faces with perfect skin, or the trees of a Maine summer, forever leafy and green.

Katz (in studio) works nonstop for hours.

Yet, sometimes, even the elegant Ada can look grave, on the brink of tears. And the landscapes can be dark—most notably, his haunting "nocturnes" or night scenes, with their nuanced layers of darkness far moodier than so many of the crisp and colorful portraits. In the recent series of sunsets, for example, Katz, in essence, is capturing the passing of time. It was hard to make the oil sketches, he reports—only 15 minutes or so on a Maine porch before dusk fell. In these large paintings, seen together, time passes quickly, and the sky becomes an impossible orange, reflected in the lake. Then, in the next painting, the lake has turned dead, to gray. These pictures, with black trees in the foreground, are elegiac—their subject is the last few minutes of daylight that no one can hang onto.

Luckily, there is consolation, even what Katz calls a kind of eternity, in art itself. "That's the difference between a painting and a sunset," he says. "The painting will stay with you, but the sunset disappears." And so Katz keeps his focus on the moment, painting like there's no tomorrow.

Writer **CATHLEEN MCGUIGAN** *lives in New York City.*
Photographer **STEPHANIE SINCLAIR** *is also based in New York.*

STEPHANIE SINCLAIR / VII; ALEX KATZ / PACEWILDENSTEIN GALLERY, LICENSED BY VAGA, NEW YORK (2)

***Morning with Rocks*, 1994; *Beach Sandals*, 1987). The artist, writes critic Carter Ratcliff, is defined by a desire to "picture the riveting instant."**

INSIDE A GLASS CASE SITS A PLAIN-LOOKING TUBE, worn and scuffed. Lying in the street, it would look like a length of old pipe. But as I approach it, Derrick Pitts—only half in jest—commands: "Bow down!"

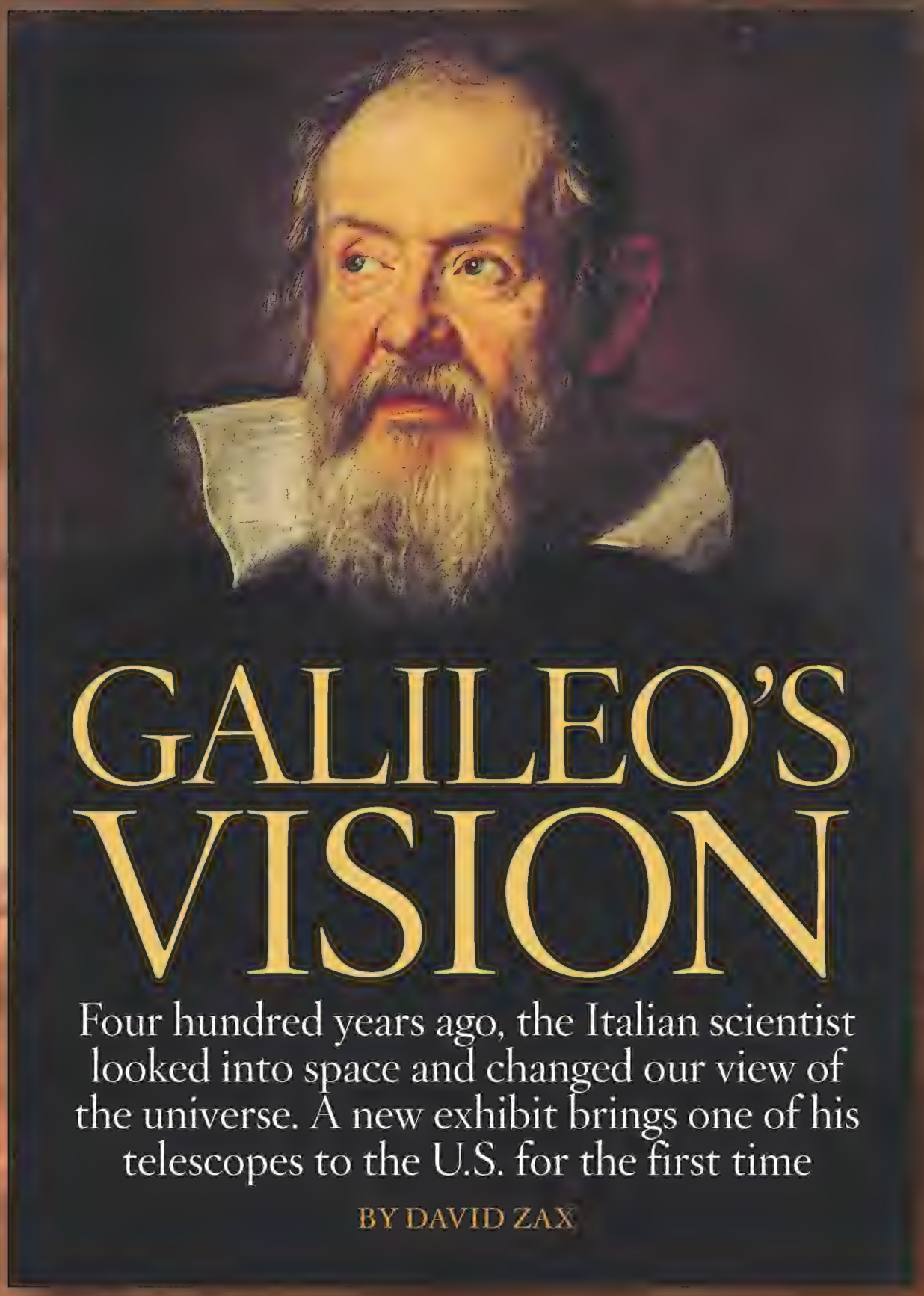
The unremarkable-looking object is in fact one of the most important artifacts in the history of science: it's one of only two surviving telescopes known to have been made by Galileo Galilei, the man who helped revolutionize our conception of the universe. The telescope is the centerpiece of "Galileo, the Medici and the Age of Astronomy," an exhibition at the Franklin Institute in Philadelphia (until September 7).

Pitts, who runs the institute's planetarium and other astronomy programs, says that receiving the telescope from Florence's Institute and Museum of the History of Science—the first time the instrument has ever left Florence—was "something of a religious experience." Understandably so: if Galileo is considered a patron saint of astronomy, then his telescope is one of its holiest relics. "Galileo's work with the telescope unleashed the notion that ours is a sun-centered solar system and not an Earth-centered solar system," says Pitts. In other words, from that ugly old cylinder came the profound idea that we are not the center of the universe.

It was a dangerous idea, and one that cost Galileo his freedom.

Turning an eye to the heavens (above: one of Galileo's telescopes; opposite: his portrait in Florence's Uffizi Gallery) was no small step for a man. Galileo was the first to discover the moons of Jupiter (background).

ON A STARRY NIGHT in Padua 400 years ago, Galileo first turned a telescope toward the sky. It might seem the most natural of actions—what else does one do with a telescope, after all? But in 1609, the instrument, which had been invented only the year before by Dutch opticians, was known as a "spyglass," in anticipation of its military uses. The device was also sold as a toy. When Galileo read of it, he quickly set about making a much more pow-



GALILEO'S VISION

Four hundred years ago, the Italian scientist looked into space and changed our view of the universe. A new exhibit brings one of his telescopes to the U.S. for the first time

BY DAVID ZAX

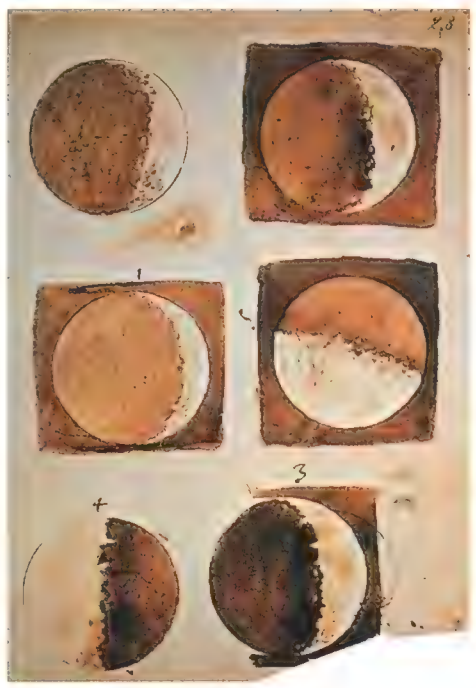
erful version. The Dutch telescopes magnified images by 3 times; Galileo's telescopes magnified them by 8 to 30 times.

At the time, astronomy, like much of science, remained under the spell of Aristotle. Almost 2,000 years after his death, the giant of Greek philosophy was held in such high regard that even his most suspect pronouncements were considered unimpeachable. Aristotle had maintained that all celestial objects were perfect and immutable spheres, and that the stars made a dizzying daily journey around the center of the universe, our stationary Earth. Why scrutinize the sky? The system had already been neatly laid out in books. Astronomers "wish never to raise their eyes from those pages," Galileo wrote in frustration, "as if this great book of the universe had been written to be read by nobody but Aristotle, and his eyes had been destined to see for all posterity."

In Galileo's day, the study of astronomy was used to maintain and reform the calendar. Sufficiently advanced students of astronomy made horoscopes; the alignment of the stars was believed to influence everything from politics to health.

Certain pursuits were not in an astronomer's job description, says Dava Sobel, author of the bestselling historical memoir *Galileo's Daughter* (1999). "You didn't talk about what the planets were made of," she says. "It was a foregone conclusion that they were made of the fifth essence, celestial material that never changed." Astronomers might make astrological predictions, but they weren't expected to discover anything new.

So when Galileo, then 45 years old, turned his telescope to the heavens in the fall of 1609, it was a small act of dissent. He saw that the Milky Way was in fact "a congeries of innumberable stars," more even than his tired hand could draw. He saw the pockmarked surface of the moon, which, far from being perfectly spherical, was in fact "full of cavities and prominences, being not unlike the face of the Earth." Soon he would note that Jupiter had four moons of its own and that Venus had moonlike phases, sometimes waxing to a disk, sometimes waning to a crescent. He later saw imperfections in the sun. Each discovery drew Aristotle's system further into question and lent ever more support to the dangerously revolutionary view that Galileo had privately come to hold—set out just a half-century earlier by a Polish astronomer named Nicolaus Copernicus—that the Earth traveled around the sun.



Galileo (top: in a 19th-century engraving) improved upon the original telescope design. The moon, he could see (above: his sketches), was no perfect sphere.

"I give infinite thanks to God," Galileo wrote to powerful Florentine statesman Belisario Vinta in January of 1610, "who has been pleased to make me the first observer of marvelous things."

LIKE MANY FIGURES whose names have endured, Galileo wasn't shy about seeking fame. His genius for astronomy was matched by a genius for self-promotion, and soon, by virtue of several canny decisions, Galileo's own star was rising.

In Tuscany, the name Medici had been synonymous with power for centuries. The Medici family acquired and wielded it through various means—public office, predatory banking and alliances with the powerful Catholic Church. Conquest was a method favored in the late 16th century, when the head of the family, Cosimo I, seized many regions neighboring Florence. The family took a keen interest in science and its potential military applications.

The Medicis may have needed scientists, but scientists—and especially Galileo—needed the Medicis even more. With a mistress, three children and an extended family to support, and knowing that his questioning of Aristotelian science was controversial, Galileo shrewdly decided to court the family's favor. In 1606, he dedicated a book about a geometric and military compass to his student Cosimo II, the family's 16-year-old heir apparent.

Then, in 1610, on the occasion of his publication of *The Starry Messenger*, which detailed his telescopic findings, Galileo dedicated to Cosimo II something far greater than a book: the very moons of Jupiter. "Behold, therefore, four stars reserved for your illustrious name," wrote Galileo. ". . . Indeed it appears that the Maker of the Stars himself, by clear arguments, admonished me to call these new planets by the illustrious name of Your Highness

He saw the pockmarked surface of the moon, which was "full of ca

GRANGER COLLECTION, NEW YORK; BIBLIOTECA NAZIONALE, FLORENCE / GRANGER COLLECTION, NEW YORK; PP. 58-59
MICHAEL BENSON / KINETIKON PICTURES / CORBIS; P. 58 MATT ROURKE / AP IMAGES; P. 59 SCALA / ART RESOURCE, NY

vities and prominences, being not unlike the face of the Earth."

before all others." (Galileo chose the name "Cosmian stars," but Cosimo requested "Medicean stars" instead, and the alteration was duly made.) "*The Starry Messenger* was a job application," says Owen Gingerich, an astronomer and science historian at the Harvard-Smithsonian Center for Astrophysics—and, sure enough, Galileo got what he was seeking: the Medicis' patronage.

Some scholars were disturbed by Galileo's observations (above: a display in Florence of his instruments), but he gave thanks for being "the first observer of marvelous things."

He could hardly have hoped for better patrons, as the Franklin exhibit makes clear. It includes scores of intricately wrought instruments from the family's collection. The names of the ingenious contraptions hint at their function and describe their form—nautical planispheres, gimbaled compasses, horary quadrants, armillary spheres. One of the oldest surviving astrolabes, an instrument for calculating the position of the sun and stars, is on exhibit, as is a set of brass and steel compasses believed to have belonged to Michelangelo, another Medici beneficiary.

Though capable of measuring the world in various ways and to various ends—determining the caliber of projectiles, surveying land, aiding navigation—some of the instruments were never used, having been collected for the very purpose to which the Franklin puts them today: display. A few, such as a compass that collapses into the shape of a dagger, demonstrate the era's alliance of science and power. But they also illustrate its blending of science and art—the gleaming artifacts rival works of sculpture. They tell, too, of a growing awareness that, as Galileo said, nature was a grand book ("*questo grandissimo libro*") written in the language of mathematics.

NOT EVERYONE TOOK PLEASURE IN—or even believed—what Galileo claimed to have seen in the sky.

Some of his contemporaries refused to even look through the telescope at all, so certain were they of Aristotle's wisdom. "These satellites of Jupiter are invisible to the naked eye and therefore can exercise no influence on the Earth, and therefore would be useless, and therefore do not exist," proclaimed nobleman Francesco Sizzi. Besides, said Sizzi, the appearance of new planets was impossible—since seven was a sacred number: "There are seven windows given to animals in the domicile of the head: two nostrils, two eyes, two ears, and a mouth. . . . From this and many other similarities in Nature, which it were tedious to enumerate, we gather that the number of planets must necessarily be seven."

Some who did deign to use the telescope still disbelieved their own eyes. A Bohemian scholar named Martin Horky wrote that "below, it works wonderfully; in the sky it deceives one." Others nominally honored the evidence of the tele-

DAVID ZAX *has written for* SMITHSONIAN *about Elvis in the Army, a party of Santas and George Washington's boyhood home.*

ERICH LESSING / ART RESOURCE, NY

scope but scrambled to make it conform to their preconceptions. A Jesuit scholar and correspondent of Galileo named Father Clavius attempted to rescue the idea that the moon was a sphere by postulating a perfectly smooth and invisible surface stretching above its scarred hills and valleys.

The Starry Messenger was a success, however: the first 500 copies sold out within months. There was a great demand for Galileo's telescopes, and he was named head mathematician at the University of Pisa.

In time Galileo's findings began to trouble a powerful authority—the Catholic Church. The Aristotelian worldview had been integrated with Catholic teachings, so any challenges to Aristotle had the potential to run afoul of the church. That Galileo had revealed flaws in celestial objects was bothersome enough. But some of his observations, especially the changing phases of Venus and the presence of moons around other planets, lent support to Copernicus' heliocentric theory, and that made

SIDEREVS,
NVNCIVS
MAGNA, LONGEQVE ADMIRABILIA Spectacula pandens, suspiciendaq; proponens vnicuiq; præsertim vero
PHILOSOPHIS, atq; ASTRONOMIS, quæ
GALILEO GALILEO PATRITIO FLORENTINO
Patauini Gymnasii Publico Mathematico
PERSPICILLI
Nuper a se reperta beneficio sunt obseruata in LVNÆ FACIE, FIXIS INNVMERIS, LACTEO CIRCVLO, STELLIS NEBVLOSIS,
Apprime vero in
QVATVOR PLANETIS
Circa IOVIS Stellam disparibus interuallis, atq; periodis, celeritate mirabili, circumuolutis; quos, nemini in hanc vsq; diem cognitos, nouissime Auctor deprehendit primus, atque
MEDICEA SIDERA
NVNCVPANDOS DECREVIT.
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Prostat Francof. in Paltheniano.

Galileo's work potentially heretical. Biblical literalists pointed to the book of Joshua, in which the sun is described as stopping, miraculously, "in the midst of heaven, and hasted not to go down about a whole day." How could the sun stop if, as Copernicus and now Galileo claimed, it was already stationary? By 1614, a Dominican friar named Tommaso Caccini preached openly against Galileo, calling the Copernican worldview heretical. In 1615 another Dominican friar, Niccolò Lorini, filed a complaint against Galileo with the Roman Inquisition, a tribunal instituted the previous century to eliminate heresy.

These church challenges greatly troubled Galileo, a deeply pious man. It is a common misconception that Galileo was irreligious, but as Dava Sobel says, "everything he did, he did as a believing Catholic." Galileo simply believed that Scripture was not intended to teach astronomy, but rather, as he wrote in a 1613 letter to his disciple Benedetto Castelli, to "persuade men of the truths necessary for salvation." Some members of the church held the same opinion: Cardinal Baronius in 1598 said that the Bible was meant "to teach us how to go to heaven, not how the heavens go."

Late in 1615, Galileo traveled to Rome to meet with church leaders personally, eager to present his discoveries and make the case for heliocentrism. But Baronius' view turned out to be the minority one in Rome. Galileo was cautioned against defending Copernicanism.

Eight years later, a new pope—Urban VIII—ascended and Galileo again requested permission to publish. Pope Urban granted permission—with the caveat that Galileo should present the theory hypothetically. The book Galileo finally published in 1632, *Dialogue Concerning the Two Chief World Systems*, however, came off clearly in favor of the Copernican view, infuriating the pope.

And so, in what Pope John Paul II would deem, more than three centuries later, a case of "tragic mutual incomprehension," Galileo was condemned by the Holy Office of the Inquisition for being "vehemently suspected of heresy, namely of having held and believed the doctrine which is false and contrary to the Sacred and Divine Scriptures, that the Sun is the center of the world." He was sentenced to imprisonment, which was commuted to house arrest for the by then ailing 69-year-old man.

Despite repeated requests for clemency, the astronomer spent his last eight years confined to his home, forbidden to speak or write of the topics that had so captivated him. (Meanwhile, forbidden copies of his *Dialogue* were widely sold on the black market.) Blindness overcame him, and as he wrote to a friend in 1638, "The universe which I with my astonishing observations and clear demonstrations had enlarged a hundred, nay, a thousandfold beyond the limits commonly seen by wise

A written fragment—a shopping list jotted on a letter—allows hist

Galileo's work pleased the Medicis (top: the title page of *The Starry Messenger*, in which he named Jupiter's moons "the Medicean stars"). But the Holy Office of the Inquisition (above: a 19th-century painting) condemned him for questioning that the Earth is the center of the universe.

SSPL / THE IMAGE WORKS; RÉUNION DES MUSÉES NATIONAUX / ART RESOURCE, NY

Learn more about the scientific instruments on display at the Franklin Institute at Smithsonian.com/Galileo

orians to surmise the materials Galileo used in making his lenses.

men of all centuries past, is now for me so diminished and reduced, it has shrunk to the meager confines of my body."

AT THE FRANKLIN, just beyond the telescope that Galileo held to his eye sometime in the early 17th century, is a room devoted to the history of the device that allowed him to see so far. Through the eyepieces of reproductions, visitors can see what Galileo would have seen on those starry nights in Italy.

The exact composition of some of Galileo's telescopes remains a mystery. A written fragment—a shopping list jotted on a letter—allows historians to surmise the materials Galileo used for his lenses. And so the ingredients for one of the most famous telescopes in history—an organ pipe, molds for shaping lenses, abrasives for polishing glass—are thrown in with reminders to buy soap, combs and sugar.

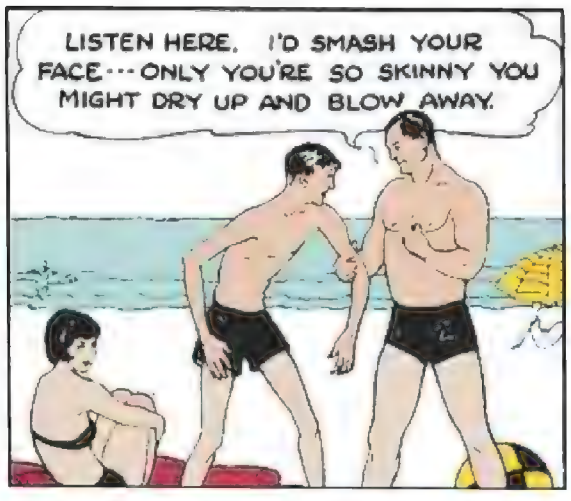
It's a humdrum list—as plain as the lusterless tube sitting in the Franklin. Yet what came from that tube, like the man who made it, was anything but ordinary. Galileo "was one of those who was present at the birth of modern astronomy," says Harvard-Smithsonian's Gingerich.

Top: The Franklin Institute's Derrick Pitts shows off Galileo's telescope, on exhibit with instruments from the Medici collection. Above, clockwise from upper left: a timepiece for day or night; a sundial with nine faces; an astrolabe for calculating star positions; a globe of the heavens.

In the dedication of *The Starry Messenger*, addressed to Cosimo II, Galileo hailed the effort to "preserve from oblivion and ruin names deserving of immortality." But the moons of Jupiter he named the Medicean have come to be more commonly known as the Galilean moons, and in 1989, the spacecraft NASA launched to study them was named *Galileo*. And 2009 has been named the International Year of Astronomy by the United Nations in honor of the 400th anniversary of Galileo's first telescopic observations.

The fame Galileo sought and obtained, he earned. "Galileo understood what was fundamentally important" about his telescopic observations, says Gingerich. "Namely, that they were showing us a whole new universe."

RYAN DONNELL; FRANKLIN INSTITUTE (4)



Muscle Man

How the original 97-pound weakling transformed himself into **Charles Atlas** and brought the physical fitness movement to the masses **BY JONATHAN BLACK**

Like tens of thousands of young men

and boys before him, Tom Manfre first caught sight of Charles Atlas in the back pages of the comic books he read so voraciously. With a sculpted chest, leopard briefs girdling his hips, a piercing look on his granite-jawed face, Atlas seemed to be jabbing his finger at Manfre as he commanded: "Let Me Prove in 7 Days That I Can Make You a New Man!"

It was 1947, Manfre was 23 years old, and the man in the leopard-pattern briefs was the toast of New York City. He'd helped President Franklin Roosevelt celebrate his birthday at the Waldorf Astoria hotel. He cavorted on radio with Fred Allen and Eddie Cantor and on television with Bob Hope and Garry Moore. He stripped off his shirt at a Paris dinner party tossed by the designer Elsa Schiaparelli. His measurements had been entombed in the famous Crypt of Civilization, the repository of records at Oglethorpe University in Atlanta intended for unsealing in the year 8113. Scarcely a day went by that a newspaper columnist didn't feature an item about Atlas—dropping by to bend a couple of railroad spikes, perhaps, or ripping a Manhattan phone book in half.

Manfre stuck a check for $29.95 in the mail and got back a 12-lesson course of exercises the author called Dynamic-Tension. For 90 days, Manfre did the prescribed squats and leg-raises and sit-ups. He followed the tips on sleep and nutrition. He remembered to chew his food slowly. Pleased with the results, he sent a photograph of his new and improved body to Atlas and was invited to drop by to meet the man himself.

"I felt like a kid in a candy store," Manfre, 86, says today. "I was thrilled! He put an arm around me and said, 'God was good to me, and I'm sure he'll be good to you.'" When Manfre won the Mr. World contest six years later, the first person he called to thank was Charles Atlas.

Manfre was not alone in his gratitude. During Atlas' heyday—the 1930s and '40s—two dozen women worked eight-hour days to open and file the letters that poured into his downtown Manhattan office. Grateful knock-kneed boys with scrawny arms and sunken chests reported that their lives had been turned around. King George VI of England signed up. Boxers and bodybuilders gave Dynamic-Tension a whirl. Mahatma Gandhi—Gandhi!—wrote to inquire about the course. A 1999 A&E biography, "Charles Atlas: Modern Day Hercules," included testimonials from Arnold Schwarzenegger and Jake "Body by Jake" Steinfeld.

This year marks the 80th that Atlas' mail-order company has been in business. Atlas himself is long gone—he died in 1972—and Charles Atlas Ltd. now operates out of a combined shrine, archive and office over a nail salon in the northern New Jersey town of Harrington Park. But the Internet has given Dynamic-Tension a new life. From all over

It took more than leopard-print briefs to turn bullied teenager Angelo Siciliano (above: in 1908) into mail-order maestro Charles Atlas (left: circa 1935).

CHARLES ATLAS LTD. (3)

the world, letters and e-mails continue to pour in, testament to one of the most successful fitness programs ever devised. And to its mythic founder.

The man who made history marketing his muscles was an unlikely hero. Born in Acri, a tiny town in southern Italy, he arrived with his parents at Ellis Island in 1903 at age 10. His name was Angelo Siciliano, and he spoke not a word of English.

He didn't look like much, either. Skinny and slope-shouldered, feeble and often ill, he was picked on by bullies in the Brooklyn neighborhood where his family had settled, and his own uncle beat him for getting into fights. He found little refuge at Coney Island Beach, where a hunky lifeguard kicked sand in his face and a girlfriend sighed when the 97-pound Atlas swore revenge.

On a visit to the Brooklyn Museum, he saw statuary depicting Hercules, Apollo and Zeus. That, and Coney Island's sideshow, got him thinking. Bodybuilding was then a fringe pursuit, its practitioners consigned to the freak tents beside the fat lady and the sword swallower. Alone at the top was Eugen Sandow, a Prussian strongman discovered by showman Florenz Ziegfeld. Sandow toured vaudeville theaters, lifting ponies and popping chains with his chest. Atlas pasted a photo of Sandow on his dresser mirror and, hoping to transform his own body, spent months sweating away at home with a series of makeshift weights, ropes and elastic grips. The results were disappointing, but on a visit to the Bronx Zoo one day he had an epiphany, or so he would recall in his biography *Yours in Perfect Manhood*, by George Butler and Chris Gaines. Watching a lion stretch, he thought to himself, "Does this old gentleman have any barbells, any exercisers? . . . And it came over me. . . . He's been pitting one muscle against another!"

Atlas threw out his equipment. He began flexing his muscles, using isometric opposition and adding range of motion to stress them further. He tensed his hands behind his back. He laced his fingers under his thighs and pushed his hands against his legs. He did biceps curls with one arm and squeezed his fist down with the other. Experimenting with varied techniques, and likely aided by exceptional genes, Atlas emerged from many months at home with a physique that stunned school chums when he first revealed himself on the beach. One of the boys exclaimed, "You look like that statue of Atlas on top of the Atlas Hotel!"

Several years later, he legally changed his name, adding Charles from his nickname "Charlie."

Holding up the world, however, wasn't a career. Atlas was too mild-mannered to go chasing neighborhood bullies, though on the New York subway he once lifted a troublemaker by his lapels and issued him a stern warning. A dutiful son, he learned leatherworking to pay the rent and support his mother. (His father had taken one look at his adopted home and high-tailed it back to Italy.) But Charlie hadn't built up his chest just to make purses. Eventually, he gave up on the leatherwork and took a $5-a-week job, doubling as janitor and strongman at the Coney Island sideshow, where he lay on a bed of nails and urged men from the audience to stand on his stomach.

"He's a knockout!" exclaimed Gertrude Vanderbilt Whitney. Atlas (in a 1924 brochure) would pose for her and several other New York City sculptors.

And this might have been the last anyone heard of Charles Atlas had an artist not spotted him on the beach in 1916 and asked him to pose.

A boom in public sculpture was coming, and busy carvers were desperate for models with well-built bodies. Among the most prominent was socialite sculptor Gertrude Vanderbilt Whitney, who, watching Atlas disrobe, exclaimed, "He's a knockout!" Further impressed by his ability to hold a pose for 30 minutes, she soon had him running from studio to studio. By the time he was 25, Atlas was everywhere, posing as George Washington in Washington Square Park, as *Civic Virtue* in Queens Borough Hall, as Alexander Hamilton in the nation's capital. He was *Dawn of Glory* in Brooklyn's Prospect Park and *Patriotism* for the Elks' national headquarters in Chicago. Photographs of him in classic poses, nude or shockingly close to it and with more than a whiff of eroticism, suggest how much he liked the camera and the camera liked him.

And the money was good—$100 a week. Still, Atlas was restless, and ambitious, and when he saw an ad for a "World's Most Beautiful Man" photo contest, he sent in his picture.

JONATHAN BLACK *wrote* Yes, You Can! *(2006), about motivational speaking. He is now at work on a book on fakery.*

CHARLES ATLAS LTD.

The contest was sponsored by *Physical Culture* magazine, the brainchild of Bernarr Macfadden, a publisher and fitness fanatic, as well as one of the most bizarre figures in the annals of fitness entrepreneurs. (He would later found a publishing empire with *True Story* and *True Romances* magazines.) Macfadden was obsessive about his health. When he wasn't fasting, he ate carrots, beans, nuts and raw eggs. He slept on the floor and walked to work barefoot. Impressed with Atlas' photograph, he asked the young man to stop by his office. When Atlas stripped to his leopard bikini, Macfadden stopped the contest, though he waited for a second visit to hand over the $1,000 winner's check and celebrate with a glass of carrot juice.

Atlas got an even bigger jolt of publicity when, in 1922, Macfadden followed up the contest with "The World's Most Perfectly Developed Man" extravaganza at Madison Square Garden. Seven hundred and seventy-five men competed for the title, judged by a panel of doctors and artists. When Atlas walked away with a second trophy, Macfadden called a halt to any more contests, grousing that Atlas would win every year. Likely, he was merely hyping Atlas' next showstopper: starring in a Macfadden short, silent movie called *The Road to Health*, directed by one Frederick Tilney, a busy if unsung health and fitness expert. On a ride to the film studios in Fort Lee, New Jersey, one day, Tilney and Atlas decided to set up a mail-order business to sell an exercise routine. When, after a few years, their collaboration ended, Atlas went solo.

But an extraordinary body did not translate into a head for business, and, within a few years, the company floundered. With profits lagging, Atlas' advertising agency in 1928 turned over his account to its newest hire, Charles Roman, who was 21 and fresh out of New York University. What the young man came up with so impressed Atlas that four months after they met, Atlas offered him half the company on the condition that Roman would run it. It was the smartest move he ever made.

Roman knew a thing or two about writing ad copy and a lot about psychology, and he'd scarcely sharpened his pencils before he coined the term "Dynamic-Tension." He would do more than save the business; he would turn it into a marketing landmark. It was Roman who would write all the Atlas ads, from the "Hey, Skinny!" strips to the "97-Pound Weakling" and the "The Insult That Made a Man Out of 'Mac'" series. The ads went straight to the male psyche. They preyed on every man's insecurity—that he wasn't "man enough" to defend his girl at the beach. At a time when the entire country was reeling from the 1929 stock-market crash and its aftermath, Atlas promised to restore a million battered egos.

"When the Depression struck, a characteristic response in America was to blame ourselves," says Harvey Green, a professor of history at Northeastern University and author of *Fit for America: Health, Fitness, Sport and American Society, 1830-1940*. "Atlas interpreted the desire to transform ourselves as a way of self-improvement."

LET ME PROVE IN 7 DAYS
that I can make
YOU
a NEW MAN!
By CHARLES ATLAS
"The World's Most Perfectly Developed Man"
ALL I want is one week to prove that I can give you a powerful body of might and muscle like mine—with my quick Dynamic-Tension method.
HERE'S ALL YOU DO:
It's Easy My Way
Accept My FREE BOOK
CHARLES ATLAS As He Is Today
FREE BOOK

"The idea that physical size could give you confidence was a powerful message," says historian Harvey Green. A 1932 Atlas ad played off Depression-era uncertainty.

The story of the two Charleses—Atlas and Roman—was a marriage of muscle and marketing that permanently altered America's approach to fitness. Before them, exercise had been the habit of a few, motivated by health first with vanity a distant second. Roman's ads heralded a new view of a man's body—as a measurement of success. As people migrated from rural America to cities filled with offices, making an impression became a priority. It was why Dale Carnegie, author of *How to Win Friends and Influence People*, had won so many readers. But where Carnegie preached advancement through social skills, Atlas evangelized for the body beautiful.

"Carnegie's message was, fit in—Atlas' was to be bigger than everybody else," says Green. "Then nobody would mess with you. The idea that physical size could give you confidence was a powerful message."

Brute size was all well and good, but proportions were what mattered to Atlas. "I don't stress the matter of chest expansion," he told *Family Circle* magazine in 1939, "because it is not important. . . . I've had a fellow in here who could blow himself up like a frog . . . but it was just a trick, and he was underdeveloped in every way." Nor did big biceps impress Atlas as much as well-developed abs. In one of his lessons, he wrote, "It is all very well to have strong arms and a grip of steel, but of what use are these unless the abdominal area is in perfect condition?" The paragraph concludes: "The rectus abdomus muscles will stand out firmly like a washboard."

CHARLES ATLAS LTD.

His values were curiously old-fashioned, even quaint. Manfre was always surprised by Atlas' interest in his life. "He'd constantly ask me questions. 'What did you do yesterday? How's it going? Did you go to church? I've got a new exercise you should add in.'" That Atlas never stopped working to improve his exercise program also impressed Manfre. "He kept studying animals," says Manfre, "and not just four-legged ones. He'd say, 'See that bird fly? See how he flaps his wings to push out his chest?' I'd sit there amazed."

The personal touch was his hallmark; his lessons took the form of letters signed by the man himself: "Yours for Health and Strength" or "Yours for Perfect Development" or "Yours in Perfect Manhood" or (during World War II) "Yours for a Lasting Peace." Long before personal trainers, Atlas tried to create an intimate bond with his "students." That the exercises could be performed alone at home, without risk of embarrassment at a YMCA or club, was part of their appeal. "You will understand these exercises better," Atlas empathized, "if you read them out loud to yourself in a private room where you will not be disturbed."

Atlas' partner Charles Roman (above: left) provided marketing muscle. The company's success allowed the Atlas family (top) to maintain a vacation home on Long Island.

Of course, not everyone bought into Dynamic-Tension. Most notably, Atlas feuded with a man named Bob Hoffman, who published *Strength & Health* magazine and sold York barbells on the side. In a celebrated case filed with the Federal Trade Commission in 1936, Hoffman called the Atlas system "dynamic hooey" and stood on his thumbs before the commission to prove the value of barbells. The FTC was apparently impressed—but not persuaded. In its finding of fact, it declared that Atlas "has employed and developed his said system since he was seventeen years of age and has attained his own great strength by the use of his own methods without relying upon apparatus." The FTC dismissed the suit and issued an order warning Hoffman not to disparage Atlas again.

John D. Fair, author of the biography *Muscletown USA: Bob Hoffman and the Manly Culture of York Barbell,* says he found articles in old issues of *Physical Culture* in which Atlas admitted he supplemented his exercises by using weights. But Fair also gives credit to Atlas. "He was an awfully nice guy with a great body, handsome and very strong," he told me. "He was a look, a household name. Hoffman admired him, but Hoffman was a businessman."

Terry Todd, an author and expert in sports and exercise history, who with his wife, Jan, has collected a major archive of physical culture memorabilia at the University of Texas, is also skeptical. "Dynamic-Tension can build muscle only to a limited degree," Todd says. "To build up muscle you need weights. But back then it was hard to make money in weights. You needed something cheap to make and cheap to ship. Atlas wasn't the only one who saw the value of mail order."

In fact, a fellow bodybuilder says he saw Atlas lift weights when they worked out at a Brooklyn YMCA in the early 1940s. "I never saw Augie lift heavy," says Terry Robinson, referring to Atlas by another nickname. "He just did a lot of repetitions." Robinson did not hold it against him. Atlas "was always smiling," he says. "He never showed off. He was a humble guy."

Atlas may have sneaked a few weight curls into his workouts, but as far as anyone knows he otherwise lived the virtuous life. He was an active promoter of the Boy Scouts. Asked for advice, he would say, "Live clean, think clean and don't go to burlesque shows." On the rare occasion when he dropped by a nightclub, usually in the company of Roman, he tried to talk the other patrons into switching to orange juice. And unlike Roman, who spent his growing fortune on luxury cars, yachts and private planes, Atlas had few known indulgences beyond a taste for white double-breasted suits. He lived in a four-room, fifth-floor Brooklyn apartment with his wife, Margaret, to whom he was singularly devoted, and his two children, Diana and Charles Jr. (Charles Jr. died last year of respiratory failure at age 89; Diana, now 89, declined to be interviewed for this article.) The family retreat was a modest home at Point Lookout on Long Island.

But he seemed to love the limelight. There are innumerable photos of Atlas hoisting bathing beauties or horsing around with boxers Max Baer and Joe Louis and golfer Gene Sarazen. He seemed to delight in publicity

CHARLES ATLAS LTD. (2); P. 69 CHARLES ATLAS LTD.; CPL ARCHIVES / EVERETT COLLECTION; CHARLES ATLAS LTD.

In the gym, Atlas "never showed off. He was a humble guy," a fellow bodybuilder insisted. But the entrepreneurial muscleman was not shy about participating in publicity stunts to build his business. In the 1920s and '30s, playing tug of war with the Rockettes atop Radio City Music Hall (above left), hoisting the goods at an auto show in Manhattan (above right) and ripping a phone book for a crowd in Bermuda.

stunts, most of them engineered by Roman. He leashed himself to a 145,000-pound locomotive in a Queens railroad yard and towed it 112 feet. He entertained inmates at Sing-Sing (prompting the headline "Man Breaks Bar at Sing-Sing—Thousands Cheer, None Escape"). To protest an office dress code, he encouraged all the women on his staff to wear shorts to work in the summer. Then he appointed his private secretary president of the Long Live Shorts Club.

Atlas may have been more canny than he seemed. He never missed the chance to promote his business, whether posing with fans or lamenting the slovenly state of American manhood. A guest "appearance" with former heavyweight champion Jack Dempsey on a radio show in 1936, following a trip to England to open a London branch of the company, gives a flavor of Atlas' promotional skills:

DEMPSEY: Well, Charlie, I am certainly glad to see you safely back in the United States, but thought you might surprise us all by coming back on the German zeppelin.

ATLAS: No, but if they ever reach the stage where they have flying gymnasiums I might do that, Jack.

DEMPSEY: How did you find the English people, Charlie? Did they seem to be in as good physical condition as our boys over here?

ATLAS: On the contrary, they appeared in much better physical condition than our boys. The Englishman . . . doesn't allow that chest of his to slip down below his belt, where you find most of the American chests. If some of the boys over here don't begin taking daily exercises, they'll be carrying their paunches around in baskets."

As the world prepared for the 1936 Olympic Games in Berlin and the specter of National Socialism grew more alarming, Atlas bemoaned the poor state of U.S. distance running and touted the value of exercise to improve the readiness of American troops. "A study of the reasons for rejection of army applicants made by Atlas," read one syndicated newspaper story, "shows that nearly one-third of the defects are those which could be largely minimized by proper care and training." He was past the age to serve in the military, but he posed for a Treasury Department sale of Victory Bonds.

Though never a zealot like Macfadden, he was single-minded in trumpeting the value of health and the means to attain it. His exercises were framed with detailed lifestyle advice: on how to dress, sleep, breathe, eat and relax. (He urged "Music Baths.") He penned long treatises on various maladies, and his company published books on everything from child rearing to relationship advice. In his view, marriage itself was subject to the vagaries of a robust sense of well-being. "The lack of glorious, vigorous health," he noted, "would prove to be, if the divorce records were analyzed, the most common reason why so many marriages 'crack up.'" He even counseled on the best way to start the day: "Get up immediately on awakening in the morning. . . . Don't dillydally. GET UP!"

"Get up immediately on awakening. . . . Don't dillydally," Atlas (in 1964, still keeping office hours) told followers.

By the 1950s the business counted nearly a million pupils worldwide and the Dynamic-Tension regimen had been translated into seven languages. Ads in more than 400 comic books and magazines brought in 40,000 new recruits each year. Celebrity pupils included comedian Fred Allen, Rocky Marciano, Joe DiMaggio and Robert Ripley. (Ripley once wrote in his "Believe It or Not" column that he saw Atlas swim a mile through storm-tossed waters off a New York beach to tow a rowboat and its panicked occupants back to shore.)

Even as Atlas' days slipped into mundane routine, and he himself slipped into middle age, he would show up most afternoons at his Manhattan office to answer mail and preach fitness to fans who came by to view their idol in person. Dinner in Brooklyn was invariably broiled steak and fresh fruit and vegetables. He often ended the day practicing Dynamic-Tension in the mirror, though he also exercised regularly at the New York Athletic Club, where he was secure enough to offer marketing tips to potential rivals.

"I was working out at the club in the late '50s when I ran into Atlas," remembers Joe Weider, founder of *Muscle & Fitness* magazine and a former competitive bodybuilder then marketing barbells. "He came over to me and tried to offer me some business advice. He said a 100-pound barbell set was heavy to ship. Then he said, 'Joe, I just send a course and some pictures, and I make so much more money than you. You should do that, too.'"

Atlas suffered a jarring blow in 1965 when Margaret died of cancer; he was so distraught he briefly considered joining a monastery. Instead, he fell back on what he knew best: tending to his body. He took long runs on the beach near Point Lookout. He bought a condominium in Palm Beach, Florida, and kept up a morning routine of 50 knee bends,

Learn about other famous bodybuilders at Smithsonian.com/bodybuilders

LEE LOCKWOOD / TIME LIFE PICTURES / GETTY IMAGES

"He put his arm around me and said, 'God was good to me, and I'm sure he'll be good to you, too," says Tom Manfre (above right: in Land O' Lakes, Florida, June 2009). Manfre used the Atlas workout to become Mr. World in 1953 (above left).

100 sit-ups and 300 push-ups. Occasionally a photo of him appeared, bronzed and flaunting his godlike chest, his measurements almost exactly the same as those enshrined in the Crypt of Civilization. In 1970, he sold his half of the company to Charles Roman but continued on as a consultant. On December 23, 1972, Charles Atlas died in a Long Island hospital of a heart attack. He was 79 years old.

It was the beginning of the fitness boom. The year Atlas died, maverick inventor Arthur Jones introduced his first Nautilus exercise machine, which offered variable resistance; it was joined on the workout floor by the Lifecycle exercise bike, which got its marketing kick from the budding science of aerobics. Other workout routines—Pilates, step aerobics, Spinning—would lure members to ever-multiplying health clubs. Charles Atlas Ltd., meanwhile, was selling the same mail-order course, but without Atlas as living icon and with neither branded equipment nor a franchised gym, the company profile dimmed. One day, Roman received a letter from Jeffrey C. Hogue, an Arkansas lawyer who said he'd idolized Atlas since the course rescued him from terminal insecurity decades earlier—and he wanted to buy the business.

"We met at the Players Club," Hogue recalls. "Mr. Roman told me how much [money] he wanted and I did something I advise no client ever to do. I didn't negotiate. It just didn't feel right."

Hogue declines to disclose the sale price, but he says he had to borrow a considerable portion of the money. The company's global reach surprised him, he says—he recounts that the first letter he opened was from a student in Nepal—but it was making only a modest profit.

And then the Internet brought Charles Atlas back to life.

It turned out the World Wide Web was the perfect marketing tool: cheaper even than the back pages of comics, international in scope, the ideal vehicle for mail-order sales. Seemingly immune from inflation—the course now sells for $49.95, only $20 more than in the early 1930s—Atlas' promise to "Make You a New Man!" was only a click away in banner ads on youth-oriented sites. The company says it now does 80 percent of its business online. "We are literally overwhelmed by the Web site activity," says Hogue, who declines to provide figures on revenue or growth. And such high-profile brands as the Gap, Mercedes and IBM have licensed the Atlas image or "Hey, Skinny!" comic strips for retro advertisements.

Charles Atlas came from a simpler time. His publicity stunts would hardly have interested today's celebrity magazines. He neither drank nor smoked, and his personal life was free of scandal. Steroids, had they been available then, would not have interested him. He sprang from the back pages of comic books and promised every bullied, insecure young man the means to take control of his life.

If he hadn't been real, no one would have believed him.

CHARLES ATLAS LTD.; ANDREW KAUFMAN

There is a time to fish

and a time to dry nets—so goes the Chinese proverb. And there is a time to take pictures, as Johan Ensing of the Netherlands well knows. Vacationing in China's Yunnan Province, he drove past Erhai Lake, noticed a family of fishermen preparing their nets for the day and resolved to return when the light was right. He roused himself early the next morning and dashed for the lake, hoping the fishermen would still be there. They were. So was a golden light. He captured a timeless moment in China's hinterlands, the Grand Prize winner for *Smithsonian*'s 6th Annual Photo Contest.

LIKE ENSING, many of our readers have shown themselves to be enthusiastic and talented photographers. We received more than 17,000 entries from professionals and amateurs in 99 countries. They demonstrated mastery over a great range of subjects—a starfish raising an arm as if to hail the sun; a pair of Bangladeshi women hitching a ride between speeding train cars; a contemplative still life of people settling in for dinner in Kyoto. Each was entered in one of our five categories: Americana, The Natural World, People, Travel and Altered Images.

A gallery of our finalists' work is available online at Smithsonian.com. An exhibition of our winners and selected finalists' photographs, "World View: Smithsonian Magazine Photo Contest," will be on display at the Smithsonian Castle through January 17. —JESSE RHODES

TIMELY CATC

More than 5,000 photographers from 50 states and 99 countries shared their vision in

HES

our 6th Annual Photo Contest

GRAND PRIZE WINNER

JOHAN ENSING, AGE 51

DRIEHUIS, NETHERLANDS

PHOTOGRAPHED OCTOBER 2008

Ensing and the Chinese fishermen he shot that day did not share a common tongue, but that didn't matter. The language of photography proved universal. "I asked the fishermen if it was OK to take some shots. (In other words, I held up my camera and showed them my most friendly grin.) For more than a half-hour, I made my pictures."

WINNER: AMERICANA

GORDON STILLMAN, AGE 24
RICHMOND, VIRGINIA
PHOTOGRAPHED OCTOBER 2008

"I took photographs of many rides, but I was drawn to this one in particular because I wanted to capture the motion and excitement people feel when they are on the ride," says Stillman. "Like in a memory, some parts of this photo are clearer than others."

WINNER: PEOPLE

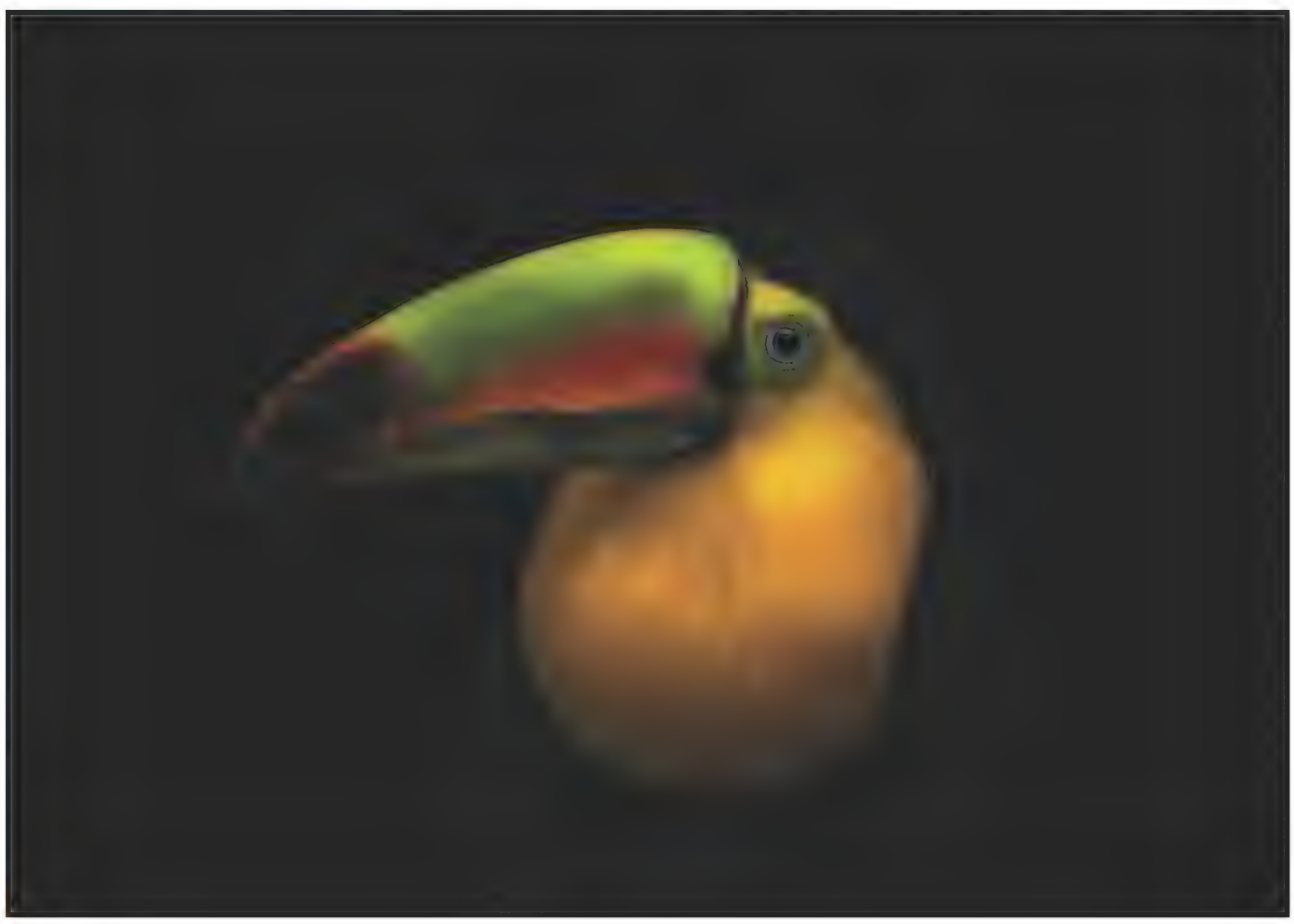
WAHID ADNAN, AGE 28
CHITTAGONG, BANGLADESH
PHOTOGRAPHED JANUARY 2008

"I took this photo while traveling on this train's rooftop," says Adnan. "In a country like Bangladesh, there are many people who live beside the railway and the railway becomes part and parcel of their lives." Those who could not afford to buy a ticket clambered on top with Andan or teetered between coaches.

WINNER: ALTERED IMAGES

PAT ABBOTT, AGE 49
WASHINGTON, NEW JERSEY
PHOTOGRAPHED JULY 2008

"I just love birds. They have such great personalities," says Abbott, who visited the National Zoo in Washington, D.C. to photograph the animals. "The toucan really stood out, with those vivid colors and the large bill," she says. "I spent more time at his exhibit than any other in the zoo. He seemed to be posing just for me."



WINNER: TRAVEL

BOGDAN BRATOSIN, AGE 30
REDMOND, WASHINGTON
PHOTOGRAPHED JANUARY 2008

Strolling through Kyoto's Gion district, Bratosin looked up and saw the brightly lit restaurant. He felt as if he were peering into a dollhouse carefully arranged with figures inside. "I've looked at this restaurant as the perfect representation of the mixture of traditional and modern, which is present everywhere in Kyoto," he says.

WINNER: THE NATURAL WORLD

BRANDON PENDRED, AGE 25
SPARTANBURG, SOUTH CAROLINA
PHOTOGRAPHED OCTOBER 2006

Walking the beach after a strong storm struck Kiawah Island, S.C., Pendred found a starfish washed ashore, its arm gently uplifted. "In my mind," he recalls, "I thought that was a cry for help, or maybe it was just trying to say, 'Hello, please try not to step on me.' I took a few photos and then picked him up and laid him back in the water."

View current and past photo contest finalists at Smithsonian.com/photofinalists

WINNER: READERS' CHOICE

DAN MONAKIL, AGE 50

VAN NUYS, CALIFORNIA

PHOTOGRAPHED OCTOBER 2007

The first San Geronimo Mission in Taos, New Mexico, was destroyed during an 1847 uprising. "From one of the damaged walls," says Monakil, "the view of the cemetery serves as a reminder of the more than 150 people who perished during the revolt." The remnants of the Spanish church stand tall, "as if still protecting its parishoners."

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PRESENCE OF MIND

In the '80s, the challenge was to limit acid rain from power plants; now, it's to cut carbon emissions.

WALTER BIBIKOW / PHOTOLIBRARY

Blue Sky Thinking

How an unlikely mix of environmentalists and free-market conservatives hammered out the strategy known as cap-and-trade

BY RICHARD CONNIFF

JOHN B. HENRY was hiking in Maine's Acadia National Park one August in the 1980s when he first heard his friend C. Boyden Gray talk about cleaning up the environment by letting people buy and sell the right to pollute. Gray, a tall, lanky heir to a tobacco fortune, was then working as a lawyer in the Reagan White House, where environmental ideas were only slightly more popular than godless Communism. "I thought he was smoking dope," recalls Henry, a Washington, D.C. entrepreneur. But if the system Gray had in mind now looks like a politically acceptable way to slow climate change—an approach being hotly debated in Congress—you could say that it got its start on the global stage on that hike up Acadia's Cadillac Mountain.

People now call that system "cap-and-trade." But back then the term of art was "emissions trading," though some people called it "morally bankrupt" or even "a license to kill." For a strange alliance of free-market Republicans and renegade environmentalists, it represented a novel approach to cleaning up the world—by working with human nature instead of against it.

Despite powerful resistance, these allies got the system adopted as national law in 1990, to control the power-plant pollutants that cause acid rain. With the help of federal bureaucrats willing to violate the cardinal rule of bureaucracy—by surrendering regulatory power to the marketplace—emissions trading would become one of the most spectacular success stories in the history of the green movement. Congress is now considering whether to expand the system to cover the carbon dioxide emissions implicated in climate change—a move that would touch the lives of almost every American. So it's worth looking back at how such a radical idea first got translated into action, and what made it work.

The problem in the 1980s was that American power plants were sending up vast clouds of sulfur dioxide, which was

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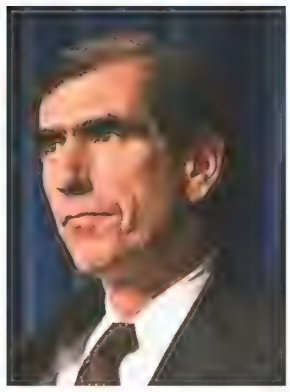
falling back to earth in the form of acid rain, damaging lakes, forests and buildings across eastern Canada and the United States. The squabble about how to fix this problem had dragged on for years. Most environmentalists were pushing a "command-and-control" approach, with federal officials requiring utilities to install scrubbers capable of removing the sulfur dioxide from power-plant exhausts. The utility companies countered that the cost of such an approach would send them back to the Dark Ages. By the end of the Reagan administration, Congress had put forward and slapped down 70 different acid rain bills, and frustration ran so deep that Canada's prime minister bleakly joked about declaring war on the United States.

At about the same time, the Environmental Defense Fund (EDF) had begun to question its own approach to cleaning up pollution, summed up in its unofficial motto: "Sue the bastards." During the early years of command-and-control environmental regulation, EDF had also noticed something fundamental about human nature, which is that people hate being told what to do. So a few iconoclasts in the group had started to flirt with marketplace solutions: give people a chance to turn a profit by being smarter than the next person, they reasoned, and they would achieve things that no command-and-control bureaucrat would ever suggest.

The theory had been brewing for decades, beginning with early 20th-century British economist Arthur Cecil Pigou. He argued that transactions can have effects that don't show up in the price of a product. A careless manufacturer spewing noxious chemicals into the air, for instance, did not have to pay when the paint peeled off houses downwind—and neither did the consumer of the resulting product. Pigou proposed making the manufacturer and customer foot the bill for these unacknowledged costs—"internalizing the externalities," in the cryptic language of the dismal science. But nobody much liked Pigou's means of doing it, by having regulators impose taxes and fees. In 1968, while studying pollution control in the Great Lakes,



Activist Fred Krupp (left) and C. Boyden Gray (right), then White House counsel, were early supporters of the strategy.

University of Toronto economist John Dales hit on a way for the costs to be paid with minimal government intervention, by using tradable permits or allowances.

The basic premise of cap-and-trade is that government doesn't tell polluters how to clean up their act. Instead, it simply imposes a cap on emissions. Each company starts the year with a certain number of tons allowed—a so-called right to pollute. The company decides how to use its allowance; it might restrict output, or switch to a cleaner fuel, or buy a scrubber to cut emissions. If it doesn't use up its allowance, it might then sell what it no longer needs. Then again, it might have to buy extra allowances on the open market. Each year, the cap ratchets down, and the shrinking pool of allowances gets costlier. As in a game of musical chairs, polluters must scramble to match allowances to emissions.

Getting all this to work in the real world required a leap of faith. The opportunity came with the 1988 election of George H.W. Bush. EDF president Fred Krupp phoned Bush's new White House counsel—Boyden Gray—and suggested that the best way for Bush to make good on his pledge to become the "environmental president" was to fix the acid rain problem, and the best way to do that was by using the new tool of emissions trading. Gray liked the marketplace approach, and even before the Reagan administration expired, he put EDF staffers to work drafting legislation to make it happen. The immediate aim was to break the impasse over acid rain. But global warming had also registered as front-page news for the first time that sweltering summer of 1988; according to Krupp,

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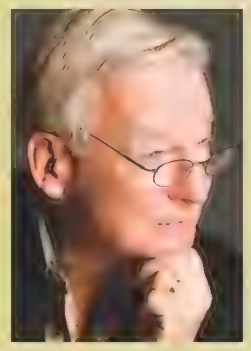

Chris Harris

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EDF and the Bush White House both felt from the start that emissions trading would ultimately be the best way to address this much larger challenge.

It would be an odd alliance. Gray was a conservative multimillionaire who drove a battered Chevy modified to burn methanol. Dan Dudek, the lead strategist for EDF, was a former academic Krupp once described as either "just plain loony, or the most powerful visionary ever to apply for a job at an environmental group." But the two hit it off—a good thing, given that almost everyone else was against them.

Many Environmental Protection Agency (EPA) staffers mistrusted the new methods; they had had little success with some small-scale experiments in emissions trading, and they worried that proponents were less interested in cleaning up pollution than in doing it cheaply. Congressional subcommittee members looked skeptical when witnesses at hearings tried to explain how there could be a market for something as worthless as emissions. Nervous utility executives worried that buying allowances meant putting their confidence in a piece of paper printed by the government. At the same time, they figured that allowances might trade at $500 to $1,000 a ton, with the program costing them somewhere between $5 billion and $25 billion a year.

Environmentalists, too, were skeptical. Some saw emissions trading as a scheme for polluters to buy their way out of fixing the problem. Joe Goffman, then an EDF lawyer, recalls other environmental advocates seething when EDF argued that emissions trading was just a better solution. Other members of a group called the Clean Air Coalition tried to censure EDF for what Krupp calls "the twofold sin of having talked to the Republican White House and having advanced this heretical idea."

Misunderstandings over how emissions trading could work extended to the White House itself. When the Bush administration first proposed its wording for the legislation, the EDF and EPA staffers who had been working on the bill were shocked to see that the White

Once President George H.W. Bush signed the Clean Air Act of 1990, the cap-and-trade system had the force of law. But it still had to prove itself in the marketplace.

House had not included a cap. Instead of limiting the amount of emissions, the bill limited only the *rate* of emissions, and only in the dirtiest power plants. It was "a real stomach-falling-to-the-floor moment," says Nancy Kete, who was then managing the acid rain program for the EPA. She says she realized that "we had been talking past each other for months."

EDF argued that a hard cap on emissions was the only way trading could work in the real world. It wasn't just about doing what was right for the environment; it was basic marketplace economics. Only if the cap got smaller and smaller would it turn allowances into a precious commodity, and not just paper printed by the government. No cap meant no deal, said EDF.

John Sununu, the White House chief of staff, was furious. He said the cap "was going to shut the economy down," Boyden Gray recalls. But the in-house debate "went very, very fast. We didn't have time to fool around with it." President Bush not only accepted the cap, he overruled his advisers' recommendation of an eight million-ton cut in annual acid rain emissions in favor of the ten million-ton cut advocated by environmentalists. According to William Reilly, then EPA administrator, Bush wanted to soothe Canada's bruised feelings. But others say the White House was full of sports fans, and in basketball you aren't a player unless you score in double digits. Ten million tons just sounded better.

Near the end of the intramural debate over the policy, one critical change

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took place. The EPA's previous experiments with emissions trading had faltered because they relied on a complicated system of permits and credits requiring frequent regulatory intervention. Sometime in the spring of 1989, a career EPA policy maker named Brian McLean proposed letting the market operate on its own. Get rid of all that bureaucratic apparatus, he suggested. Just measure emissions rigorously, with a device mounted on the back end of every power plant, and then make sure emissions numbers match up with allowances at the end of the year. It would be simple and provide unprecedented accountability. But it would also "radically disempower the regulators," says EDF's Joe Goffman, "and for McLean to come up with that idea and become a champion for it was heroic." Emissions trading became law as part of the Clean Air Act of 1990.

Oddly, the business community was the last holdout against the marketplace approach. Boyden Gray's hiking partner John Henry became a broker of emissions allowances and spent 18 months struggling to get utility executives to make the first purchase. Initially it was like a church dance, another broker observed at the time, "with the boys on one side and the girls on another. Sooner or later, somebody's going to walk into the middle." But the utility types kept fretting about the risk. Finally, Henry phoned Gray at the White House and wondered aloud if it might be possible to order the Tennessee Valley Authority (TVA), a federally owned electricity provider, to start buying allowances to compensate for emissions from its coal-fired power plants. In May 1992, the TVA did the first deal at $250 a ton, and the market took off.

Whether cap-and-trade would curb acid rain remained in doubt until 1995, when the cap took effect. Nationwide, acid rain emissions fell by three million tons that year, well ahead of the schedule required by law. Cap-and-trade—a term that first appeared in print that year—quickly went "from being a pariah among policy makers," as an MIT analysis put it, "to being a star—every-

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body's favorite way to deal with pollution problems."

Almost 20 years since the signing of the Clean Air Act of 1990, the cap-and-trade system continues to let polluters figure out the least expensive way to reduce their acid rain emissions. As a result, the law costs utilities just $3 billion annually, not $25 billion, according to a recent study in the *Journal of Environmental Management*; by cutting acid rain in half, it also generates an estimated $122 billion a year in benefits from avoided death and illness, healthier lakes and forests, and improved visibility on the Eastern Seaboard. (Better relations with Canada? Priceless.)

No one knows whether the United States can apply the system as successfully to the much larger problem of global warming emissions, or at what cost to the economy. Following the American example with acid rain, Europe now relies on cap-and-trade to help about 10,000 large industrial plants find the most economical way of reducing their global warming emissions. If Congress approves such a system in this country—the House had approved the legislation as we went to press—it could set emissions limits on every fossil-fuel power plant and every manufacturer in the nation. Consumers might also pay more to heat and cool their homes and drive their cars—all with the goal of reducing global warming emissions by 17 percent below 2005 levels over the next ten years.

But advocates argue that cap-and-trade still beats command-and-control regulation. "There's not a person in a business anywhere," says Dan Esty, an environmental policy professor at Yale University, "who gets up in the morning and says, 'Gee, I want to race into the office to follow some regulation.' On the other hand, if you say, 'There's an upside potential here, you're going to make money,' people do get up early and do drive hard around the possibility of finding themselves winners on this."

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For people like me, who want a cell phone that's easy to use. Over the years, cell phones have become smaller and smaller with lots of complicated features. They are hard to use, and hard to see. But the Jitterbug cell phone has simplified everything, so it's not only easy to use, it's easy to try. No crowded malls, no waiting in line, no confusing sales people, or complicated plans. Affordable and convenient cell phone service is only a toll-free phone call away.

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Trial Period	30 days	30 days	

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WARNING: IS YOUR MEMORY FADING?

Breakthrough medical research reveals "forgotten moments" may be caused by "brain starvation"

You may be able to avoid long-term issues if you act before it's too late. Leading medical researchers reveal discovery that triggers body's own production of mental "superfuel" and may help reverse the damage caused by stress and age.

Do you remember your first kiss but not where you left your car keys? You're not alone. Millions are discovering that as they age, their short term memory and mental sharpness seem to be slipping. The cause of these inconvenient "gaps" in memory sits deep inside your brain, among the billions of tiny nerve connections. New brain cell growth starts dropping after age 25, and then dramatically after 50, starting a downward spiral that can lead to everything from those frustrating "senior moments" to even more severe memory breakdowns.

Downward Memory Spiral is Reversible

Studies have shown that the efficiency of brain cells declines after years of free radical damage and stress. It was long believed that as we got older, memory problems were inevitable. But medical experts have revealed that **the downward memory spiral is reversible.** Compelling new research shows that there's a simple way to stimulate new brain cell growth that can boost your memory, improve your focus and restore your mind's mental sharpness.

Achieve Peak Brain Performance

Challenging mental games aren't enough to build a better brain. Your mind is the most complex and demanding organ in your body. It's also a high-performance supercomputer that requires the right chemical "foods" to perform at its peak.

One of the brain's most important nutrients is choline. Choline is a substance in our body that our brain desperately needs to help manufacture new cells and improve vital neurotransmitters (the basic processes of thinking and memory). Until now, it was believed that there was no way to safely and naturally produce this remarkable mental "superfuel." But after years of extensive research and testing, microbiologists and brain researchers at the University of North Carolina, in England at Newcastle General Hospital, and at the prestigious Weizmann Institute of Science in Israel have developed a way to help boost choline production. Their breakthrough formula also helps stimulate new brain cell growth, leading to a significant improvement in memory, concentration and helps clear stubborn "brain fog."

Are you starving your brain?

If you have experienced one or more of these symptoms, you may benefit from Neurostin™.

- ☑ Do you forget names or dates?
- ☑ Do you sometimes get confused?
- ☑ Do you find it difficult to do more than one thing at a time?
- ☑ Do you often forget why you walked into certain rooms?
- ☑ Do you find it hard to concentrate?

Improve Memory and Focus Without a Prescription

This exciting breakthrough discovery is now available in a ***time-release capsule*** called Neurostin™ Complex-Memory Pill that is available without a prescription to anyone looking to sharpen their memory. Neurostin™ contains a unique combination of antioxidants, botanicals and nutrients to support critical processes for good cognitive function. Its high concentration of specific brain-boosting ingredients helps improve the synthesis and transmission of neurotransmitters necessary for improved mental clarity. The Neurostin™ formula is completely safe and contains no stimulants, ephedra or caffeine.

Protect Your Memory Now Before It's Too Late

Why wait until your lack of focus or forgetfulness creates an unsafe situation? Today it was your reading glasses, but tomorrow it could be the stove. You forget a phone number today, but tomorrow it could be where you parked your car at the mall.

Just as important is the personal toll that a fading memory can take on your family and friends. Don't you owe it to them and your future to take your brain's fitness as seriously as you do your heart health? It couldn't be easier. In as little as 30 days you can get back the mental sharpness and focus you had when you were 20 years younger! Act today and unlock your mind's true potential!

How Neurostin™ Works

- **Provides the building blocks** of nerve cell membranes to promote optimal brain cell activity
- **Assists in the production** of acetylcholine, a vital component for improved mental performance
- **Helps relax blood vessels** to increase blood flow for maximum nutrient and oxygen delivery
- **Helps dispatch antioxidants** which inhibit free radical oxidation of nerve cell membranes

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Darwin for Dads

A daughter tries to help one member of an endangered species survive

BY JOE QUEENAN

WHEN MY DAUGHTER WAS SMALL, I used to take her to the American Museum of Natural History in New York City. There, I would explain why the dinosaurs disappeared and how mankind evolved from our primitive forebears. She seemed rapt. But a few weeks ago, after hearing me on the radio discuss a new book about Charles Darwin, my daughter, now 25, suggested that we reverse roles—she'd take me to the museum. She said my understanding of Darwinism needed some fine-tuning.

I am not one of those lunkheads who interpret evolution as meaning only the fittest survive and their survival proves that they deserved to outlast other species. But I am one of those people who believe things usually happen for a reason, even if it is a bad one. My daughter, who studied biochemistry at Harvard, paid my entry to the museum, and then gently explained that my theory was completely wrong.

"In one sense Darwinism does connote survival of the fittest," she said. "But it's not judgmental. In any situation, you have a variety of pressures on an organism: What is the atmosphere, is there food available, what is the competition for resources?" She said this as we ambled past a looming skeleton of an apatosaurus—which was called a brontosaurus when she first saw it from a backpack at the tender age of 6 months. "This dinosaur didn't disappear because it did something wrong. The pressures on it changed, and other species were better able to cope."

"Then how come you're smarter than me?" I asked. "Isn't this like baby giraffes growing longer necks to reach the tastiest fruit? Isn't nature saying, 'This clown doesn't know anything about evolution, so his daughter will evolve into an organism that does'?"

"No," she responded. "Evolution is random."

I still had my doubts. Freelance writing is a terrible way to make a living. Freelance satire is even worse. Wasn't the fact that my daughter was planning to be a neuroscientist—thereby acquiring a marketable skill that would land her a good job with benefits and a pension—a sign that she was further along the evolutionary chain than me.

"No," she said (again). "That's what's wrong with social Darwinism, the notion that if we align all the elements properly, the species will improve."

"But what if your mother and I created an environment where you would grow up to have a more plausible career than your dad?" I asked.

"That's the old question of nature versus nurture," she replied, as we surveyed a rare breed of tamarin. "Look at it this way: nature is not pushing us in a particular direction; it's just pushing. Nature is hand-squeezing a tube of toothpaste. Eventually the tube will burst. The organisms that stay in the tube of toothpaste are the fittest. The others get flushed down the drain. That doesn't mean they're defective or that they deserved to get flushed away. It's not that they weren't tough enough. Maybe all the things that their species were selecting for stopped being suitable to a new environment."

"Like old-media writers seeing their markets dry up as newspapers get replaced by blogs?" I responded.

"If the atmosphere filled up with nitrogen, mankind would not survive," she continued, as we inspected an extinct species of bird. "That does not mean that mankind deserved to die. It means that circumstances changed."

"So freelance humorists are exactly like the vanished species of oxen we just passed?" I asked. "And this story is a warning to other wiseacres to mutate in another direction?"

She pondered that one for a minute, no doubt mystified as to how a father as misinformed as hers could have possibly spawned a scientist.

"I think we might need to make another trip to the museum," she said, diplomatically. "This could take a while."

JOE QUEENAN, *the author of nine books, writes regularly for the* New York Times, *the* Los Angeles Times *and the* Guardian.

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